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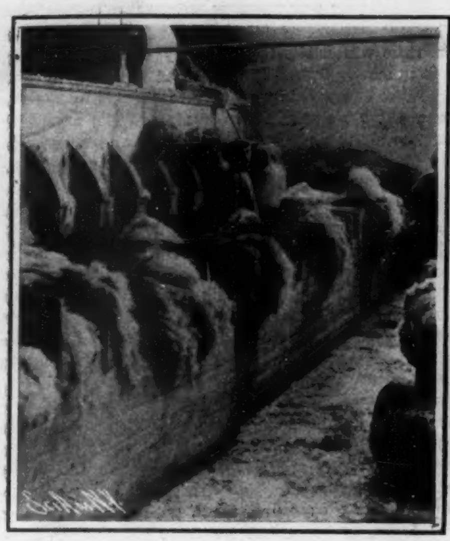

Scutching Mill, Showing the Scutched Flax.

Cleaning the Flax Fiber. Hand Scutching.

A Modern Rippling Machine.

The Flax Harvest. The Plants Made Into Bundles Prior to Stacking.

Rippling Machine in Operation.

Crates of Flax Weighted and Sunk in the River Lys.

An Old-Time Scutching Mill.

THE CULTIVATION OF THE FLAX PLANT AND THE PREPARATION OF THE FIBER FOR TEXTILE PURPOSES.—[See page 458.]

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NEW YORK, SATURDAY, DECEMBER 9, 1905.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

GUARD RAILS IN THE SUBWAY.

The contemplation of what would happen if a train of cars were to jump the track in the Subway and strike the wall of columns which supports the roof, has led a correspondent to forward to this office a sketch of a section of the Subway, showing two continuous lines of guard rails riveted horizontally to the vertical columns, one line being at the level of the floor of the car, and the other at about the height at which the side of the car rounds off into the roof. The object of the guard rails is to prevent a derailed car from striking, end-on, one of the columns, and so precipitating a serious wreck.

The question as to how far the supporting columns would be endangered in the event of a derailment is not a new one, and, indeed, it was given consideration by the engineers when they were working out the plans of the Subway. It was found that the clearance between the sides of the car and the columns is so small, and the cars are so long, being over 51 feet between the bumpers, that a derailed car could not become slewed around very far from its normal position parallel to the tunnel. Moreover, the columns are spaced so closely, being only five feet apart, that when a derailed car had become slewed around as far as it could go, it would be impossible for the forward end of it to strike a square blow against any particular column. The car, it is believed, would slide along the inner face of the columns as though they presented a continuous wall.

It has been suggested that in case of a derailment, especially of an express train, two or three of the columns might be carried entirely away, and thus permit the street above to fall in upon the cars. The engineers of the Subway, however, do not anticipate that the posts would be knocked out, or, if they were, that the roof would come down. The great power of resistance afforded by these columns, riveted as they are at top and bottom to the tunnel roof, and floor, was shown on one occasion during construction, when a train of cars laden with rock ran away down an incline, and crashed into a line of columns. In spite of the fact that the rock train was running at very high speed, only one of the posts was bent and none was carried away. Moreover, during the course of construction a large mass of rock torn loose in blasting operations would occasionally hit the columns and bend them out of plumb; but in no case was a column entirely carried away.

Although the above facts are not to be disputed, it must be remembered that the columns have never been subjected to an impact that would be comparable to that of an eight-car express train weighing about 350 tons, and moving at a speed of 40 miles an hour; and although on tangents it might be difficult for a derailed car to get a "bite" on any particular column, on curves and turn-outs the offsetting of the successive columns would bring them into a position more favorable to receive an end-on blow. The Scientific American is of the opinion that on such curves as those at the Grand Central Station and Times Square; and at all turn-outs, such as that at Spring Street, which are liable to be taken by express trains at high speed, it would be advisable to attach some form of guard rail to the line of posts on the outer side of the curve. A still better provision would be to use the protection which the Subway engineers have already installed at points where there is a crossover and the continuity of the line of columns is broken. Here they have incased the lower half of the columns in a wall of concrete, with the result that if a derailed train should hit the end column the blow would be resisted by the united strength and inertia of the wall and the columns that it included. It is particularly desirable that lateral guard-rail protection should be given wherever the Subway tracks pass between the foundation columns of tall buildings, such as the Times Building and the Belmont Hotel, and we understand that such protection is being put in place.

AN ALL-DAY RACE BETWEEN BATTLESHIPS.

Shortly before the opening of the recent war, the British government, it will be remembered, purchased from a South American republic that was retrenching its naval expenditures, two battleships which had recently been constructed in English yards. One of these, now known as the "Swiftsure," was built at Elswick, and the other, now named the "Triumph," at the Vickers yard. Both of these battleships, which are of the very moderate displacement of 11,800 tons, carry an armament practically as heavy and, as some experts think, heavier than that carried by the government-designed battleships of the "Duncan" class, which are of 14,000 tons displacement. Therefore, they are excellent representatives of the Elswick school of design, which, like that of our own navy, seems to be able to secure very heavy gun power in proportion to the displacement. Sir William White, the designer of the "Duncan" class, has been criticised for not securing greater offensive and defensive elements on the large displacements which he has given to his ships; but he has always contended, and we think with reason, that what his ships have lost in gun power, they have gained in endurance and reliability. The "Swiftsure" and the "Triumph" had shown, in the course of trials held in 1904, a speed under full power of over 20 knots an hour as against the designed speed of 19 knots. The "Duncan" had developed on trial a speed of 19.1 knots, and the average speed of the rest of the class was about the same. It should be mentioned that the armament of the 14,000-ton "Duncan" is four 12-inch and twelve 6-inch guns; while that of the "Swiftsure" is four 10-inch and fourteen 7.5-inch.

Naturally, the introduction of the Elswick-built ships into the British navy led to keen rivalry between them and the fast "Duncan" class, and this culminated in a twenty-four-hour race (carried out under the recent Admiralty provision for a quarterly full-power trial of all ships of the navy) which recently took place between the "Duncan" and the "Swiftsure." The battleships started on their all-day race on even terms. They were driven at full power for the whole twenty-four hours, and at the end of that time the "Duncan" was 30 miles ahead of the "Swiftsure," having put to her credit the remarkable performance, for a battleship, of maintaining for a whole day an average speed of 20.1 knots an hour. An average speed of 19.6 knots an hour was sustained by the "Swiftsure." That a 14,000-ton battleship could be able to steam for 482½ knots at an average speed of over 20 knots an hour, constitutes a record that will probably stand for some time to come.

To enable our readers to form an intelligent estimate of the relative performances of the two ships, we may mention that the "Swiftsure" is 436 feet in length, by 71 feet beam, and 24 2-3 feet in draft, and that on her official trial she made 20 knots an hour with 14,018 indicated horse-power; whereas the "Duncan" is 405 feet in length, by 75½ feet beam, and 27¼ feet draft, and on her official trial made 19.1 knots with an indicated horse-power of 18,232.

THE GROWTH OF OUR RAILROAD SYSTEM.

A sure indication of the advancement of a people is the extent and quality of the provision which it makes for transportation, and there is a pretty close relation between the growth of that system and the advancement of the people it serves. The rapidity with which the network of railroads that now covers the United States has been woven over the entire face of the land, is a subject of justifiable pride on the part of those who clearly appreciate what the upbuilding of that system has really involved in time, labor, and money. For the most part, its growth has been a healthy one, although there have been periods of wild-cat speculation, such as that of 1882, when over 11,000 miles was constructed in a single year, and again that in 1887, when nearly 13,000 miles was built. In each case these years of extravagance were followed by others of comparative stagnation, as, for instance, in the period from 1894 to 1897, when an average of only 1,700 miles was built per annum. These years of limited construction were marked by a steady increase in the freight and passenger business over the roads already constructed, and the low record of new construction simply proved that the roads were waiting for the traffic to catch up with the over-rapid construction of previous years. According to the figures which have just come to hand in Poor's "Manual of Railroads" for the fiscal year 1904, there has been a decided increase in the amount of new construction over the five years preceding, the amount of new road constructed having increased from 4,397 miles in 1903 to 5,014 miles in 1904, the total number of miles of railroad now in operation being 212,349. This vast system represents total liabilities of over $15,000,000,000, of which six and a quarter billions represent capital stock, and six and three-quarter billions the bonded debt. Among the assets, the cost of the railroads and their equipment represents over eleven and a quarter billion dollars. During the year 715,654,951 passengers were carried, and the total number of tons of freight moved reached the enormous figure of 1,275,321,607 tons. The passenger earnings amounted to $455,067,129, the freight earnings were $1,367,119,507. Other sources of income brought up the total traffic revenue for the year to just under two billion dollars. The net earnings for the year were $640,000,000, and other receipts raised the total available revenue to $721,000,000.

THE HEAVENS IN DECEMBER.

The magnificent group of constellations which adorns the winter sky is now fairly visible in the east and southeast. Orion, the finest of them all, is also the best one to use as a pointer to help us to find the others. At 9 o'clock in the evening in the middle of December, it is almost due southeast, and about one-third of the way from the horizon to the zenith. Its two brightest stars, Betelgeuse and Rigel, lie to the left and right of the line of three which form Orion's belt. Two others, not quite so bright, complete a quadrilateral which incloses the belt and also the smaller group on the right, known as the sword. The middle one of these last three stars is perhaps the most remarkable object in the heavens. A field-glass will show it double, and a small telescope resolves the brighter of the three stars seen with the field-glass into four components, to which a powerful instrument adds two more.

The whole system is surrounded by an enormous nebula, familiar to all students of astronomical literature. Part of it can be seen even with the naked eye, and more with the telescope, but it requires photographs of long exposure, made with large lenses of short focus, to bring out its faint extensions. They reveal it as a huge mass of nebulosity connected with one of the bright stars in the belt, and extending over almost the whole constellation.

The line of Orion's belt points downward to Sirius, which even at its present low altitude is easily the brightest star in the sky, and upward to Aldebaran, and beyond it to Jupiter, near which to the northward are the Pleiades.

The very bright star in the Milky Way, north of Aldebaran, is Capella, in the constellation Auriga. Below this is Gemini, marked by the twin stars Castor and Pollux, from each of which a line of fainter stars runs toward Orion. Below these again is Canis Minor, with the bright star Procyon.

The southern and southwestern sky is less interesting. Next to Orion is Eridanus, a very large constellation consisting of a crooked line of faint stars which begins close to Rigel, runs westward, then south, then southeast, and then southwest to the horizon, terminating in a bright star, Achernar, invisible in our latitude. West of this again is Cetus, which contains one pretty bright star, which stands alone about two hours west of the meridian at an altitude of about 25 deg.

The great square of Pegasus is well up in the west. Aquarius is below it. Saturn, Mars, and the bright star Fomalhaut are all in this part of the sky, but now they are just setting, and to see them we must look earlier in the evening.

Cygnus is low in the northwest, and Lyra is still lower, Vega being near setting. Cepheus, Cassiopeia, and Perseus lie in the Milky Way between Cygnus and Auriga, and Andromeda and Aries are south of them, almost overhead. Ursa Major, Ursa Minor, and Draco lie below the Pole, and so are not conspicuous.

THE PLANETS.

Mercury is evening star until the 15th, when he passes through inferior conjunction and becomes a morning star. However, he is so near the sun and so far south that he will not be visible to the naked eye this month.

Venus is morning star in Scorpio and Sagittarius, but she is also inconspicuous, rising only about an hour before the sun.

Mars is evening star in Aquarius and Capricornus, and sets at about 9 P. M. on the 15th. On the evening of Christmas day he is in conjunction with Saturn. The two planets are only half a degree from one another, and they are easily observable, as they do not set till about 8:30 P. M. They appear about equally bright, but it does not follow that viewed telescopically they would look equally large. Mars presents a very small disk, only 5½ seconds of arc in diameter, so small that it would be hidden by a silver dollar a mile distant, while the diameter of the disk of Saturn is nearly three times as great, to say nothing of his rings, which nearly double his apparent area. So if Mars and Saturn looked equally bright, *area for area*, the latter planet would appear to the eye about fifteen times as bright as the former. But they both shine by reflected sunlight, and, since Saturn is at present

about seven times as far from the sun as Mars is, a square mile of Saturn's surface receives only about one-fiftieth as much sunlight as a square mile of surface on Mars.

Hence, if the two planets reflected the same proportion of the incident light, Mars ought to look three times as bright as Saturn. But as a matter of fact, Mars is very little the brighter of the two. It follows that Saturn must reflect between two and three times as large a proportion as Mars does of the light which falls on it, and this is one of the reasons which lead us to believe that the visible surface of Saturn consists of clouds, as no surface of land and water could be expected to be such a good reflector.

Jupiter is in Taurus, and is visible all night long. The phenomena of his satellites are visible with a small telescope, and very interesting to watch. There are several favorable evenings this month. On the 7th the second satellite crosses the disk of the planet, entering on it at 8:40 P. M., followed by its shadow three-quarters of an hour later, and before these leave the planet the first satellite and its shadow also come on, at 10:33 and 10:55 respectively. The same thing happens again on the 14th, about two hours later in the evening. The 16th, the 23d, and the 30th are also remarkable occasions, especially the last two, when for some time (between 8:30 and 9 on the 23d, and between 11 and 12:30 on the 30th) Jupiter seems to have only one satellite, as the first and third are in front of the planet, and the second behind it.

Saturn is evening star in Capricornus, and sets about 9 P. M. in the middle of the month.

Uranus is in conjunction with the sun on the 26th, and is invisible throughout the month.

Neptune is in opposition on the 31st. He is then in Gemini, in R. A. 6 h. 39 m. 30 s., dec. 22 deg. 10 min. north, and is moving northwestward at the rate of one minute of time in R. A. and one minute of arc in declination, every eight days.

THE MOON.

First quarter occurs at 2 P. M. on the 3d, full moon at 6 P. M. on the 11th, last quarter at 7 A. M. on the 19th, and new moon at 11 P. M. on the 25th.

The moon is nearest us on the 23d, and most remote on the 7th. She is in conjunction with Mars on the 1st, Saturn on the 2d, Jupiter on the 10th, Mercury on the 24th, Venus on the 25th, Saturn again on the 29th, and Mars on the 30th. The last two conjunctions are close, and occultations of the two planets will be visible from points in the Pacific Ocean and in Asia.

At 7 A. M. on December 22 the sun reaches its greatest southern declination, and enters the sign of Capricornus—though not that constellation—and, in almanac parlance, "winter commences."

COMET B 1905.

A bright telescopic comet was discovered on November 17 by Schaer, of Geneva. At the time of discovery it was close to the north pole, but it has been moving very rapidly, and on November 21 was on the borders of Cassiopeia and Andromeda, in about 54 deg. north declination. It is of about the seventh magnitude, and is visible in a field-glass as a hazy spot of light. Its orbit, the elements of which have just come to hand, shows that at the time of discovery it was already retreating from the sun, but very near the earth. It is now moving rapidly away from both, and becoming much fainter. On December 2 it was in R. A. 23 h. 31 m., dec. 4 deg. 34 min. north, and only one-sixth as bright as at discovery. Within a week or so more it will be so faint and so far south that it will hardly be observable. HENRY NORRIS RUSSELL, Ph.D.

Princeton, N. J.

THE MYSTERIES OF THE OCEAN BED.

The disaster which happened to the French vessel "Sully" not so very long ago, when it went to the bottom not far from Saigon, has afforded the divers intrusted with examination of the submerged ship opportunities for making exhaustive and important explorations of the bottom of the sea. In these fields of sub-aqueous exploration special distinction has been won by a young naval engineer named De Plury, who, by the aid of an apparatus of his own invention, succeeded in reaching a depth of even more than 336 feet— a depth which had never before been attained.

De Plury has invented a kind of metal armor which affords him every protection, while by means of a special chemical combination, respiration is automatically provided for. Thanks to this, he has already made over 115 most daring descents with perfect safety. He has thus been able to discover a most marvelous world, hitherto seen by no eye but his; the sea bed is a scene of marvels combined with no small amount of tragic horrors.

"The first sensation experienced," said this intrepid diver at a recent interview with an Italian journalist, "is something like that which is felt on descending into a mine, but you soon get accustomed to it. At a depth of about nine feet medusæ began to be found in large quantities. Seen through the water, everything appears magnified, and they are apparently of enormous proportions. All recollection of the protection afforded by the glass front of the helmet is forgotten, and the first impression is that these masses of horrid flaccid and slimy medusæ will adhere to your face.

"Just a little lower down, and a scintillating multitudinous shoal of small fishes is encountered, shimmering like so many strips of shining copper, or other metal, in a state of continuous vibration.

"At a depth of about 162 feet thick masses of seaweed are traversed; some of these are hair-like vegetable growths, with arms from 20 to 30 yards in length, which, with a kind of horrid vitality, wrap themselves round every part of the body. These algæ constitute a grave danger, as they can easily paralyze the diver's movements and, by rising up above and around him, can weigh him down with a weight amounting to several hundredweight—sufficient to break a rope or lifeline when hauled on. Below 162 feet there are small snake-like fishes of about three feet in length, and also other denizens of the deep resembling dolphins. These latter hurl themselves violently against the diver. If, as already remarked, he is somewhat young at the game, and has forgotten the protection afforded by his helmet, he is still filled with a mortal dread lest they should succeed in smashing the glass front of the helmet despite its four inches of thickness. Of course, should that occur, death would be almost instantaneous.

"Still other and worse monsters are the polypi or devil fish, who wrap their slimy tentacles round the bold explorer; but although repugnant, these monsters are cowardly, and immediately renounce their attack on coming in contact with the unfamiliar feel of the metal armor plating of my diving dress. There are also equally horrible, and much more intrepid, giant crabs. Some of those I have seen have measured as much as three feet in diameter. Due to their strong shells and formidable claws, they constitute a continual menace to the safety of the diver, which is by no means to be despised. This is about all that can be said on the score of the deep-sea fauna. The deformation of fish is not very noticeable at such a small depth; by deformation I mean not only change of form, but also of character. This takes place at a depth of about 1,094 yards; here their nature changes entirely, and they assume the forms and constitutional modifications necessary to enable them to bear the enormous pressure to which they are subjected at the depth where they move and have their being.

"Hitherto it has been quite impossible to obtain living specimens of these submarine creatures, as they reached the surface with their volume quadrupled, due to the reduction of pressure. All these creatures are carnivorous, and their capacious maws not unfrequently serve as the tombs of unfortunate sailors whose ship has gone to the bottom, and their bodies gradually sink deeper and deeper, while the formidable pressure to which they are subjected in an increasing intensity soon smashes all their bones, and finally crushes the corpses quite flat. But enough; suffice it to say that this awful spectacle is scarcely visible after a depth of 30 feet.

"One curious fact attending these submarine explorations is afforded by the light, which forms a strange blend of green and violet light, the color being a little similar to that of the caverns which are to be seen in icebergs. At a depth of 32 yards the light begins to get more and more diffused, and the sun viewed through the mass of superincumbent water appears like a reddish opaque globe; but—and this is somewhat strange—when sheltered from the rays of the sun (behind a rock, for instance) the stars become visible even at midday.

"One day, just about noon, I saw a never-to-be-forgotten sight at a depth of 129 feet. The sun was right at the zenith. The bottom upon which I stood consisted of fine white sand, and the reflection of the light upon the snowy carpet gave me the impression of standing upon a plain of molten gold. At a depth of 226 feet the obscurity is complete; at 327 feet the darkness is impenetrable, and it is necessary to have recourse to electricity for purposes of vision. I use electric lamps of 10,000 candle-power, but even these cannot diffuse their light beyond a radius of 90 feet. A most tragic spectacle is then presented by sunken vessels, broken boats, splintered hulls, gaping decks, and broken masts."

No scenes of horror can be surpassed by the awful panoramas of death and disaster which have been witnessed by Engineer de Plury in the course of his professional experience as a diver.

"In the vicinity of Ostend," he relates, "I was requested once to examine the wreck of a vessel which had sunk not long ago. This was the occasion upon which I was assailed by a veritable horde of those giant crabs of which I have already spoken. They were at the time busy devouring the corpses of the dead sailors. One of these monsters seized me by the leg, which would have been crushed, as if squeezed by a jaw of steel, had it not been protected by the powerful armoring of my diving dress. I had a kind of sword in my hand, with which I succeeded in killing two of these monsters, the shells of which I still possess. All objects at the bottom of the sea are covered with a kind of curious powder, and a terrible gloom and silence prevails. What a scene of melancholy! The floor of the ocean is strewn with bones, not a few of them of human origin! A very singular fact which I have observed is that the sea, for a certain period of time, keeps bodies in a perfect state of preservation. I once visited the hull of a vessel which had gone down with all hands. The crew were mostly asleep at the moment when the disaster occurred, and had thus passed practically instantaneously from sleep to death. So far they had not been bitten or gnawed by any fish, as most of the hatchways were closed. The men still appeared as if asleep. There they lay, wrapped in a calm and mysterious slumber. I approached, and, climbing down to the hatchways, touched one of the corpses with my hand; the flesh seemed to dissolve and vanish under my hand, leaving nothing but a grinning skeleton!

"And the treasures of the seas! Millions alone are engulfed not far from Vigo. Personally, I have never been there, but one of my men once went down there clad in the old diving dress. This was before I had invented my present dress. The unhappy man died almost directly he reached the surface again; but he had had time to see several galleons lying at the bottom, with the masts still standing, and the timberwork still sound. These, of course, were some of the famous treasure ships; but I do not think it would be possible to recover them. All metals would have been destroyed by rust by now, as they have been below water ever since 1707.

"I have seen personally the vessel which, about 1808, was conveying Napoleon's treasures to Holland, but it was wrecked *en route* and sank with one hundred millions of gold on board; of these, fifty-six millions have been recovered, but the remainder, as I have said, is still in the bosom of the ocean. The Prince of Monaco states that he has found near Cyprus a galley still full of objects of art at the botttom of the sea. This is where submarine boats will have such a great future before them, as, by their aid, we shall one day be able to explore unknown deep sea grottoes, rich in unknown forms of life, vaults full of untold wealth, and the tomb of many a poor sailor."

SCIENCE NOTES.

Among the minerals which contain a considerable proportion of radium we may mention a natural phosphate of uranium known as autunite, named for the town of Autun, in France, near which it has been found. This mineral has been known for a long time past, and owing to the uranium it contains has been used for some purposes. The beds of this mineral which are found at Saint Symphorien de Marmagne, in the Seine-et-Loire district, were worked by M. de Fontenay, the director of the great Baccarat glass factories, owing to the special color which some of the crystals were found to give to the glass. The discovery of radium drew attention again to this mineral, and a new search was made to find the beds of it which had been lost. The search has been successful owing to the recent work of M. H. Mariot, and at a depth of 6 feet below ground in a special kind of marl, they found plates of autunite which reached over an inch in thickness. This mineral was found to contain a large amount of radium salts, and it acted strongly upon the photographic plate, showing that it is quite powerful in its actions. We thus have another radium-bearing mineral to add to the list.

The recently-published report of the British government dealing with the fishery and hydrographical investigations in the North Sea during the years 1902-3 contains much interesting data concerning the fecundity of fish. According to the report, the turbot is one of the most prolific of sea fishes. The number of eggs in five specimens examined varied from over five millions to more than ten millions. The heaviest of these specimens weighed only 21 pounds, and the fact is expressed that large specimens are still more fertile. There is, however, but limited information extant concerning the rate of growth of turbot, but a specimen marked and put back in the sea on May 27, 1891, had grown from six to eight inches when caught again on August 31 of the same year. Unlike some round fishes, the flat species keep to the bottom of the sea and move along it, traveling great distances. Records have been obtained showing that plaice have traveled eighty-eight miles in twenty-eight days, or an average of not less than three miles a day. Experiments in the large spawning pond of the Fishery Board's laboratory at Aberdeen showed that this fish could cover more than a mile in an hour. Apparently the brill is not so fertile as the turbot. A brill weighing only 5½ pounds had the comparatively trifling number of 825,000 eggs. The halibut takes second place as to quantity, and third as to value among all the flat fishes. In a specimen weighing 91 pounds no less than 1,327,000 eggs were found.

THE BACTERIAL PURIFICATION OF SEWAGE.

BY ALBERT [illegible].

It is only about twenty years since the first experiments in bacteriological sewage purification were made. Schloesing and Muntz in France, Warrington and Frankland in England, and the Massachusetts State Board of Health were the pioneers of the movement. The necessity for sewage purification is distinctly a modern one. It has grown out of the development of the water carriage system. In olden times many and fearful were the diseases due to the bad sanitation of streets and houses. Now, however, architects and engineers have solved that old problem, and by means of the water carriage sewerage systems, they are able to have the poisonous wastes safely conveyed away from human habitation. Nevertheless, the problem of the ultimate disposal of sewage has not yet been thoroughly solved. Man has sought to deal with the subject by building sewers to the nearest stream, and thereby removing the nuisance as far as he is concerned. But in doing this he has only transferred it in a degree to some other community, and has established the modern evil of stream pollution. It is hardly necessary for me to dwell upon the results of this evil. It is sufficient to point out that it contaminates the natural water supply of towns, kills fish, makes rivers unpleasant for boating and bathing, renders the water practically useless, and aids in the spreading of typhoid fever.

A Municipal Sewage Disposal Plant.

It would be foolish to make laws against the passing of sewage into streams if there were no better ways of disposing of it. Modern science, however, has come to the rescue. Filters have been invented and put into operation which have the power to convert the most foul and turbid sewage into clear, sparkling water, and which enable men to pass harmless effluents into the rivers.

The modern method of filtration is not a mechanical nor a chemical one; these systems have been tried, but have failed to dispose of the large quantities of impurities in solution. It is a system of breaking up animal and vegetable matter into their harmless constituent parts by means of the action of bacteria which inhabit the sewage. It is really a process of combustion or oxidation, that is to say, the converting of organic substances into inorganic. The same kind of action is seen frequently in nature. It takes place in the conversion of foliage into dried-up dead leaves and in all processes of decay. The bacterial sewage treatment system is simply the adaptation of this method of nature to the requirements of man.

Before one can understand how it is possible for such purification to be accomplished, two things must be realized. The first is the enormous force of bacteria present. The second is the insignificant bulk in sewage that requires purification. As many as 115,000,000 bacteria have been counted in one gramme (1-28 ounce) of soil from a trench along which sewage had been running. They multiply with extraordinary rapidity and, were there no forces to interfere, one bacterium would have sixteen and a half million descendants in twenty-four hours. Ordinary sewage, on the other hand, only contains one part in a thousand of dead organic matter; 998 parts are pure water and one part harmless mineral matters.

A Small Septic Tank and Contact Bed.

A Domestic Sewage Disposal Plant.

The simplest example of bacterial sewage disposal is the throwing of a pan of dish water over the ground. The liquid becomes finely divided in passing through the air, and reaches the ground in fine particles. Here the bits of grease, soap, and food refuse remain on the surface, where they are slowly oxidized by the aerobic bacteria. The liquid passes on through the earth, and is attacked by millions of micro-organisms, which search each drop for food. After a time the liquid becomes practically pure, and the retained solids have disappeared, passing off as carbonic acid, water, nitrogen, or oxides of nitrogen.

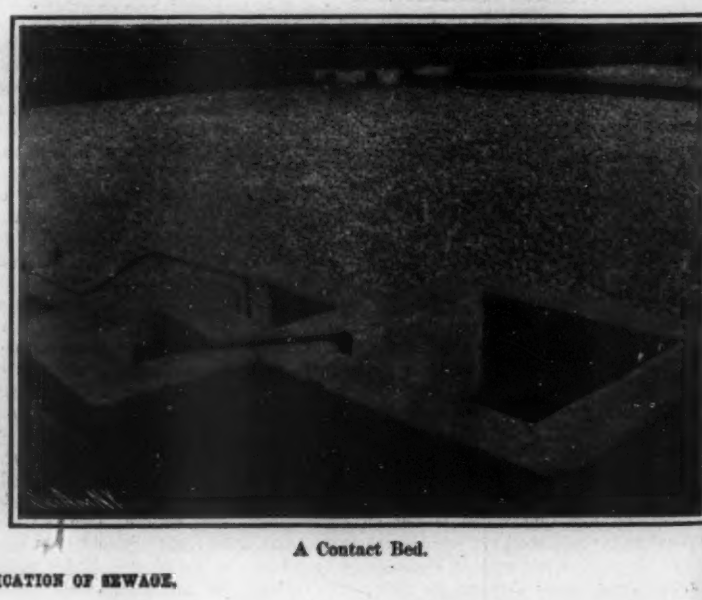
Many are the varieties of systems devised for the disposal of sewage. The patent offices of both England and the United States have been flooded with new inventions for sewage treatment. Many have proved utterly worthless, but there are several which have been operated with entire satisfaction.

I will not attempt in this article to go into details of each different method of sewage disposal, but I will give a brief description of the most important systems now in use.

The oldest of all forms of bacterial sewage disposal is known as land treatment, broad irrigation, or sewage farming. It was understood for a long time that land had the power of purifying sewage without its being known exactly what took place. Accordingly, sewage was passed over land for the purpose of purification, and at the same time was used for the fertilization of crops. This system has been in operation in many parts of England, but it can hardly be looked upon as a practical method. In some cases, however, most successful results have been obtained by land treatment, but such cases are very rare. Financially, this system can never be a success. The area of land required to purify a comparatively small volume of sewage is enormous, the expenses of operating are considerable, the land is liable to receive so much more liquid than the ordinary rainfall that it becomes "sewage sick," and useless either for purification or for raising crops. It is rapidly becoming an

(*Continued on page 458.*)

Automatic Airlock Apparatus for Controlling Contact Beds.



A Contact Bed.

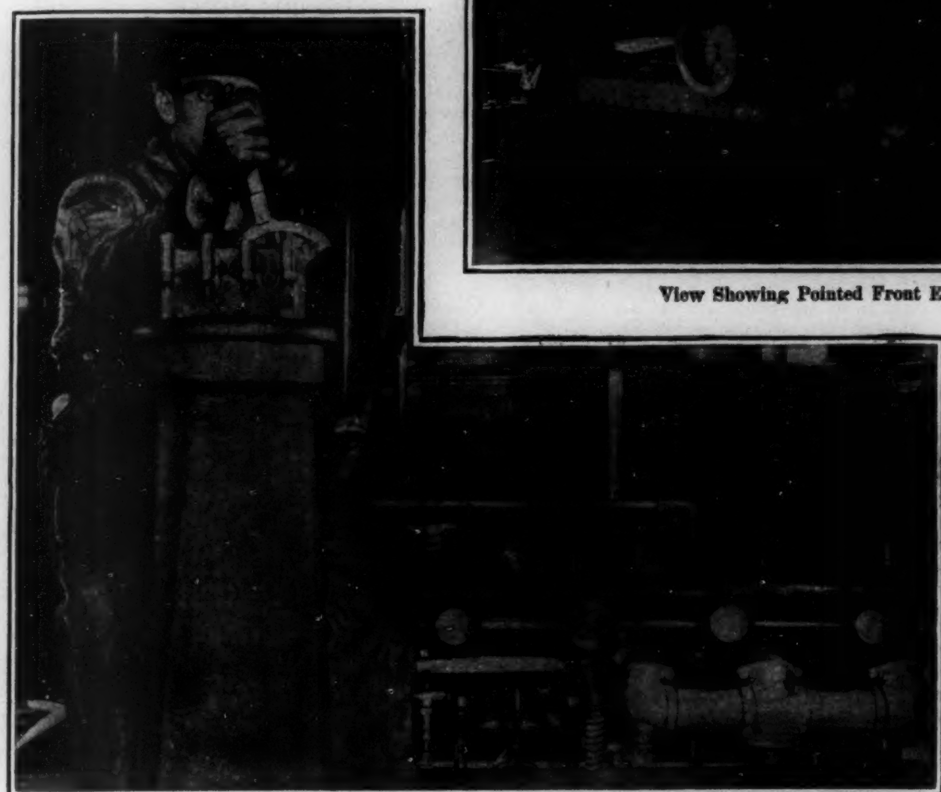
THE BACTERIAL PURIFICATION OF SEWAGE.

THE NEW GASOLINE MOTOR CAR.

In our issue of August 26 of the present year, we gave an illustrated description of the trial gasoline railroad car constructed by the Union Pacific Railroad Company. This car has proved such an unqualified success that the company has constructed a second and much larger car of the same general type, and by the courtesy of the superintendent of motive power, Mr. W. R. McKeen, Jr., we are enabled to present illustrations showing its leading characteristics. As compared with motor car No. 1, the dimensions have been increased as follows: The seating capacity has been raised from twenty-five persons to fifty-seven, the length from 31 feet to 55 feet, and while the weight of the first car was a trifle over 20 tons, the car herewith illustrated weighs 28 tons. The great reduction in weight per passenger carried is highly creditable, and it is to be attributed to the fact that the car is built entirely of steel, and that great attention has been paid to the question of strength, the material being so judiciously disposed that, although the weight is so low, there has been no sacrifice of essential stiffness and strength. In case of collision the car should afford great protection to its occupants, and render them secure against the fatal effects of telescoping. The general features of motor car No. 1 were so satisfactory that they have been embodied in the new car, particularly as regards ventilation, sanitation, heating, and lighting. The roof is domed and provided with a type of ventilators which experience has proved to be capable of thoroughly and continually renewing the air inside the car. The car is heated by means of the hot-water circulation coils, which in this case serve the double purpose of cooling the engine and heating the interior of the car. It is lighted by acetylene gas, twenty-five opalescent panel lights being provided for this purpose. The inside finish of the car is antique mahogany and the seats are finished in leather. A feature that is greatly appreciated is the provision of a semi-circular rear end, around which runs a tufted seat. As the rear is abundantly lighted by large single-glass windows, an excellent point for observation is thus afforded.

The car is driven by a 100-horse-power, six-cylinder gasoline engine, built after special railroad patterns, and designed to meet regular railroad car service requirements. It has a "make-and-break" spark ignition, with a primary battery to start on, and a magneto for regular running service. The driving wheels are 42 inches in diameter, and the other wheels of the car are 34 inches in diameter. The metal clutch operated

View Showing Pointed Front End, Which Forms the Engineer's Cab.



Cab and Engineer of a Railroad Gasoline Motor Car.

Interior View of Car.

Rear View, Showing the Rounded End and Observation Windows.

THE NEW STANDARD SIZE GASOLINE MOTOR CAR FOR THE UNION PACIFIC RAILROAD.

by hand levers which proved so successful on motor car No. 1 has been applied to car No. 2; but it is operated by air pressure controlled by a specially designed operating valve. The car is started at low speed and the engine disconnected or thrown into high speed, at will, simply by means of the operating valves.

The initial trip of this car was made on September 14, when a run took place from Omaha to Valley, Neb., on the main line of the Union Pacific, a distance of 34.8 miles. On the west-bound trip no effort was made for a fast run, but special mention should be made of the performance of the car in ascending Elkhorn Hill, where the grade is 42 feet per mile. This hill was climbed at the rate of 32½ miles per hour. The return trip was made at an average speed of 37 miles per hour, with a maximum speed during the run of 52 miles per hour.

On September 22 the car made a second trial run to Valley and return, and on the west-bound trip an average speed of 39.4 miles per hour was maintained. On the east-bound trip the car made 25 miles from Valley to Gilmore in thirty minutes, or at an average speed of 50 miles per hour. Several miles were covered in 57 seconds—a rate of 63.2 miles per hour—and mile after mile was run at a speed of over a mile a minute.

THE BACTERIAL PURIFICATION OF SEWAGE.

(*Continued from page 456.*)

out-of-date method except, perhaps, for finally disposing of sewage works effluents, or in isolated cases where topographical and other conditions are specially favorable to its adoption. Land treatment is used successfully at Berlin, Germany, on a tract of land of over 19,000 acres—larger than the city itself. It is kept in condition by convict labor. In one instance, a year of exceptional drought, the crops from these farms realized receipts which more than defrayed all cost of administration and maintenance. Land treatment on the whole, however, is haphazard, uncertain, and expensive.

In 1895 Donald Cameron, of Exeter, England, brought the septic tank into prominence. This consists of a large tank, in which sewage is allowed to remain, where it is acted upon by anaerobic bacteria—micro-organisms that live without the presence of air. Sewage contains a considerable portion of solid matter in suspension. By means of anaerobic action part of it becomes liquefied and goes into solution, part rises to the top as scum, while part descends to the bottom as sludge. The inlet and outlet of the tank are placed below the surface, so that the sewage may pass quietly through with as little commotion as possible. The scum which rises to the top becomes oxidized after a time, and passes off into the air as harmless gas. A certain amount of decomposition takes place in the sludge at the bottom. When the tanks are large, sludge accumulates very slowly at the bottom. At a septic tank at Mansfield, Ohio, only a few inches of deposit were drawn off after it had been in use for a year and a half.

The septic tank has proved a most useful factor in sewage purification. It is used extensively as preliminary treatment for contact beds and percolating filters. It cannot, however, be considered by itself as a system of purification; it can be used successfully only as part of one.

There are some small towns in this country, however, where septic tanks alone have been used. The results in those places have invariably been very poor. The septic tank by itself is regarded by sanitarians as little better than an apology for a sewage disposal plant. In some cases, however, when only a low degree of purification is needed, such as when sewage is put into the ocean, septic tanks have proved useful.

Perhaps the most practical method of sewage disposal is the combination of the septic tank and the contact bed. The contact bed system was devised by W. J. Dibdin, who installed the famous bed at the town of Sutton, England. In this system sewage is first passed through a screen, to prevent the floating particles from blocking the interstices of the bed. It is then passed over a coarse-grained bacteria bed. This consists of a tank three feet deep filled with broken stone, coke, burnt ballast, or other suitable material not more than three inches in diameter. It is supplied with underdrains, so that it can be easily emptied. The sewage is allowed to enter the bed until the level of the filtering material is reached. The inlet is then closed, and the sewage is allowed to remain standing "in contact" for a certain length of time. During this period the aerobic bacteria do their work. They oxidize the organic matter in solution, and in their search for food they decompose a considerable portion of the impurities. Furthermore, certain ferments knowns as enzymes aid in the work of decomposition, while the solid particles adhere to the filtering material. The sewage is then allowed to flow slowly out of the bed, leaving many impurities upon the filter material. It flows into another similar bed, where further similar action takes place. Now that the bed is empty, aerobic action goes on among the particles of sewage left in the interstices of the material. Before the next flush comes, most of the spongy matter in the bed has been converted into gases. When the bed fills again, the gas is driven out of the bed into the air above.

Such is the method in use at Sutton. It is simple and effective, and has been widely used in systems laid out more recently. After the sewage has been treated in a septic tank, it generally need only be treated in one contact bed to secure the necessary purification.

Most septic tank-contact bed systems contain several bacteria beds, so that while one bed is filling, another may be in contact, another emptying, and another resting empty. Four is a favorite number of beds for a small town plant, while six are often used.

The contact bed system involves only a small fall, so that it can be applied to almost any district. It has been in successful operation in many towns both in this country and in England. The secret of its success is the regularity of the time of contact and aeration. Experience has shown that unless such regularity is maintained the bacteria will not remain in healthy condition.

At Manchester, England, is the largest septic tank-contact bed system in the world. The beds are opened and closed at regular intervals by hand. In the more recent contact bed systems installed in this country, the invention of automatic airlock apparatus has made it possible to have the beds fill and empty at regular intervals automatically.

A more recently devised system of filtration, and one that is gaining favor in England, is known as intermittent downward filtration, percolating, or trickling filters. These filters are many feet in depth. The sewage is distributed in intermittent doses—often by means of a large revolving sprinkler. They are filled with material similar to that used in contact beds. At the bottom there is an open space for the circulation of air.

In order that percolating filters work successfully, great care must be taken in their construction. It is essential that air should always be present in all parts of the filter, scum must not be allowed to accumulate; there must be a thorough draining at the base, so that the filtrate may come from the filter easily and force air to come in by induction. During the fall of the sewage through the bed, the aerobic bacteria get a splendid opportunity to oxidize organic matter, provided they have a sufficient supply of air. The effectiveness of a percolating filter increases with its depth, so that the filters are made as deep as possible. They are generally used with septic tanks. This system is in use at Birmingham and Hanley, England, but it has practically never been applied in this country. The objections to its use are first the great fall required, and secondly the danger of stoppage through frost unless artificial heat is used. At an experimental plant at Leeds a purification of over 80 per cent was secured in three minutes by this method.

The method of intermittent downward filtration is largely used in New England. It is, however, merely an adaptation of the old system of land treatment. It consists of passing sewage over soil intermittently, so that the land after receiving one charge of sewage is allowed to rest for a certain space of time before receiving the next. Underneath are generally placed underdrains so that the effluent can easily escape. Although areas averaging as much as from ten to twenty acres per million gallons are necessary for these beds, the results obtained have been satisfactory. It is frequently necessary to pump the sewage to the filters. The best-known examples of intermittent downward filtration through sand are those at Brockton and Framingham, Mass. In both cases pumping stations are required. This system has one or two drawbacks besides its expense. Unless great care is taken, the sewage goes through the filters in channels instead of percolating through the material, while the beds frequently freeze and become useless in winter.

There is no doubt that the bacterial process of sewage treatment has come to stay. The question raised is no longer shall the bacterial system be used, but which kind of bacterial system best complies with the given conditions. All the methods I have described work successfully under the proper conditions, but the contact bed system has proved the most generally applicable because of the small fall required and its ability to operate in all weather.

THE FLAX INDUSTRY OF TO-DAY.

Of all the plants cultivated for fiber, flax, *Linum usitatissimum*, is doubtless one of the earliest, and we know of its existence from the times of the first authentic records. Even cotton, which was mentioned in the writings of Herodotus in 445 B. C., must take its place as a comparatively modern product with reference to its forerunner—linen. Because of this very antiquity, the origin of the flax plant is rather uncertain; but it is believed that it arose in the region between the Caspian Sea and the Persian Gulf. That it was cultivated and manufactured by the Swiss lake dwellers in the Stone Age in Europe is proved by the well-preserved specimens of straw, fiber, yarn, and cloth to be found in the museums. This ancient flax was, however, from another species, *Linum angustifolium*. The Egyptians produced and used flax thousands of years ago, and the Chaldæans and Babylonians carried its use to the highest state of development, employing it particularly in tapestry work. Three thousand years ago the Phœnicians extended the culture, the Greeks and Romans made it a household industry, and it subsequently became the aristocratic fiber. It is claimed that the ancient Mexicans were acquainted with both flax and hemp, and their culture in that country goes back far beyond the earliest date of our civilization. It was introduced in this country in Massachusetts as early as 1630.

While the plant can be grown in nearly every portion of the temperate world, flax is cultivated, primarily, for the production of fiber in central and northern Russia, in Holland, Belgium, Ireland, and northern Italy. In southern Russia, British India, Argentina, and the United States it is grown almost exclusively for seed production; in these regions the straw is used for fuel, stable bedding, and sometimes for forage. In a few localities in this country the straw is used for paper stock, or is made into upholstering tow. While the cultivation of flax for seed, and the manufacture of this into oil and oil-cake, have grown into industries of enormous proportions in the United States, only in a few vicinities is the plant grown for the production of spinning fiber. At Yale in Eastern Michigan, at Northfield and Heron Lake, Minn., and at Salem and Scio, Ore., the flax is cultivated for its fiber.

While flax was extensively grown and its fiber spun and woven during colonial times, it was used almost entirely as a home product for consumption in the families of the weavers, and it is probable that very little linen was manufactured for purposes other than this. While it is possible that after the successful termination of the Revolutionary war the industry would have grown to considerable importance in the hands of the American people, with the abolition of England's repressive colonial policy in regard to manufactures, the invention of the cotton gin by Eli Whitney checked its future development at once. This invention placed within reach of the manufacturer a fiber that was cheaper than flax, that required less care in preparation, more easily worked, superior for many purposes, and decidedly inferior for very few, and in consequence the manufacture of linen was practically abandoned. Until within comparatively recent times the attempts to reintroduce it have been few and far between and generally unsuccessful. Additional reasons for this are found in the expenditure of time and labor entailed by the retting process, in the difficulty in spinning and weaving a fiber with as little elasticity as this, in the consequent precariousness of the margin of profit, and finally, in the fact that the demand for the finished product is not nearly as broad or general as is that for other textiles. Nevertheless, while the linen industry in the United States is not extensive to-day, a considerable advance, measured in percentages, has been made in the last ten years. There are certain fields, such as the manufacture of linen carpet yarns, linen thread for the shoemaking industry, towels and towelings, in which the American manufacturers should be able to compete successfully. They have already occupied some and entered into others of these fields, and the growth of the industry in other directions is generally prophesied.

Nearly all the flax fiber used in the United States is imported from Russia, Holland, Belgium, and Ireland, while a small quantity comes from Italy and Canada. A great deal of the so-called "Irish flax" is grown in Belgium and sent to Ireland for preparation. The flax grown in this country is usually from Riga (Russian) or from Belgium Riga seed.

The culture of flax requires a deep, well-tilled soil in a high state of fertility. Wet soil such as some clays is disastrous to the crop. Similarly fatal are soils filled with the seeds of weeds. Moist, deep, strong loams upon upland in a fairly moist climate are especially favorable to the plant. The land must be deeply plowed and thoroughly harrowed. Because of a disease, flax-wilt, it cannot be cultivated year after year upon the same ground; but as the other ordinary crops are immune from the spores which remain in the soil, flax may be introduced in a rotation once in six or eight years.

Flax is sown early in the spring, broadcast like oats or wheat, the seeds being spread evenly at a depth of less than an inch. Though the root system is small, the growth of the plant is rapid, maturity being reached in about one hundred days. The crop must be thoroughly weeded, the operation beginning when it is about two inches above ground, as the quality of the plant when choked by weed is poor. The best flax is pulled out by the roots. This is done to avoid stain and injury, which would result from soil moisture while the cut stems were in the shock, to secure straws of the greatest possible length, to insure better curing of the straw and ripening of the seed, and to avoid the blunt cut ends of the fiber. The straw is often allowed to dry on the ground, and then to cure for two or three weeks in the shocks, though the practice varies somewhat in different countries. The seeds

and leaves are removed by a process called *rippling*. This is done to-day by machinery, the heads of the unbound bundles being passed between rapidly-revolving corrugated rollers, which crush the seed pods. The seeds and leaves are then removed by means of a fanning mill. After this the straw is stacked until required for the retting.

The flax fibers, which appear to consist of pure cellulose and show no signs at all of being lignified, are held together by an intercellular substance consisting mainly of calcium pectate. The object of the retting is to decompose or make soluble these woody tissues inclosing the cellulose or bast fibers, so that they can be removed from the latter by the subsequent processes.

The water-retting of flax is a biological process induced by the action of definite organisms, the chief of which is an anaerobic *Plectridium*, which in the absence of air ferments the pectin substances of the cellular material, uniting the parenchymatous tissues, and thus causes a loosening of the bast fibers. The absolute exclusion of oxygen, which is necessary in order that the fermentation may be set up, is brought about by numerous oxygen-consuming bacteria and fungi. The products formed by the fermentation of the pectin substances are hydrogen and carbon dioxide and organic acids, especially acetic and butyric acid and small quantities of valeric and lactic acids. The injurious action of the acids produced, especially butyric, may be considerably diminished by adding alkali or lime to the retting liquid. It has been found to be advantageous to inoculate the liquid at the beginning of the retting with pure cultures of the anaerobic *Plectridium*.

On the retting process depends the quality of the linen, and it is that stage of the industry which presents the greatest difficulty. There are three methods which can be employed, and of these the simplest and least careful is dew-retting. The straw is simply spread evenly over the fields like hay to be retted by the action of the dew and the elements. The fiber resulting from this method is the most uneven and the least valuable product of the three processes. With the exception of that in use at Northfield, Minn., it is the process usually employed in this country. The second method, called pool-retting, consists in immersing the bundles of straw in stagnant pools, the softest waters, such as rain water, giving the best results. Holes are dug in the ground for this purpose, though a great part of the Irish flax is retted in "bog holes." The resulting flax fiber is better than the dew-retted product and is lighter in color, being a fairly light bluish brown. The third method consists of immersing the straw in running water. This is the form practised in Belgium, where the finest product of this kind in the world, the famous Courtrai flax, is retted in the murky waters of the sluggish river Lys. The flax straw, in bundles, is placed in crates which are weighted with stones and submerged in the water of the stream for two periods, each of from four to fifteen days according to the temperature and other conditions. After the first immersion the straw is taken out and carefully dried before the second retting. The Courtrai flax is of a light creamy color and of superior tensile strength. Its excellent qualities appear to be due not so much to the retting in sluggishly running water as to the actual qualities of that water and the peculiar ferment contained therein.

After the flax has been retted it undergoes a decorticating process, which removes the bark and the loosened, underlying, woody tissues and isolates the linen fibers in a purified condition. The first operation consists of passing the straw through a breaker, which loosens the woody portions of the stems and reduces them to fragments to facilitate the following operation, the scutching, which whips out the "chive" and all other waste matters, leaving the pure flax fiber. Within recent years machinery has been designed which successfully performs all the operations subsequent to retting, but in former times the work was done by hand or with very crude mechanical aids. One of the accompanying engravings shows an old-time scutching mill, consisting of a large wheel with flat radial wooden blades projecting from its periphery. These rapidly-revolving blades slashed the waste matter from the bundles of flax straw, which were held against a flat surface parallel to the plane of the wheel. The scutched flax is subsequenty hackled or dressed by repeated combings, which remove the short and broken or tangled fibers and thereby produce tow. Each hackling improves the quality of the fiber and, of course, adds to its cost.

Numerous chemical methods have been proposed for retting flax, to improve and shorten the natural processes, and numberless patents have been granted here and abroad, covering these artificial methods. Among them are processes consisting in heating with water under pressure, boiling with solutions of oxalic acid, soda ash, caustic soda, or the addition of various chemicals to the retting water, such as hydrochloric and sulphuric acids. Numerous patents also exist on retting pools or tanks. Few of all these processes have proven of any industrial value. However, one of the exceptions to this appears to be a process covered by patents issued to two Belgians, Dr. Georges Loppens and Honoré Deswarte. Briefly, the process consists in covering a mass of vertically-arranged flax straw in special tanks with water, constantly delivering fresh water, preferably rain water, beneath the mass and at the same time constantly withdrawing the same quantity of impure water from below the level of the fresh water. This method is now used at Northfield, Minn. During the first season it was not employed with entire success, but it appears that this deficiency may be ascribed to inexperience in the handling of the apparatus rather than to any fault of the process. There is little doubt that in the future the Loppens method, as it is called, will prove entirely successful, for it is extremely simple in operation and absolutely under the control of the operative.

Airship Competition at Milan.

During the Milan exhibition, 1906, the following aeronautic competitions will be organized: Dirigible airship competition; competition of free balloons carrying operator; competition of flying devices heavier than air; competition of kites; competition of sounding balloons; photographic competition. All competitions are international.

With the exception of the dirigible airship competition, the other competitions will not take place unless there are at least two competitors. Should the competitors only be two, the second prize will not be awarded. The competitors will be allowed, after arrangement with the committee, to trials *hors de concours*. Only the trials announced and controlled by the committee will be available as competitive trials. Among the latter the "classification trials" will be chosen for the awarding of the prizes.

Should the number of competitors make it necessary, each competition will consist of eliminating trials and final trials. The competitors for the final trials will be chosen among the better-placed in the eliminating trials, and their number will be fixed by the committee.

An international committee for the aeronautic competitions will be formed, and will be chosen by the executive committee of the exposition. To this committee all questions regarding organization, execution, and surveillance of the competitions will be deferred. In these matters it will represent and substitute the executive committee.

The request for entries must be addressed to the Comitato Internazionale per i Concorsi Aeronautici, Piazza Paolo Ferrari, Milano. A special application must be forwarded for each of the competitions the applicants are desirous of entering. All applications must reach the above-named committee in the time limits fixed by the special regulations governing the single competitions.

Illiterate Children of Immigrants Compared with Children of Native Americans.

It seems somewhat surprising at first to find a lower degree of illiteracy among the children of foreign-born parents than among the children of native parents. For the former the proportion of illiteracy is 8.8 per 1,000, for the latter 44.1 per 1,000. This difference, however, does not prove that immigrants are more anxious than natives to secure for their children the advantages of an elementary education. It is explainable by the fact that the foreign-born are concentrated in the larger cities to a much greater extent than the native population. Comparison for individual cities indicates that there is little difference in illiteracy between the two classes of children living in the same community. But such differences as can be detected are usually in favor of the children of native parents.

What Water Can Do.

Imagine a perpendicular column of water more than one-third of a mile high, twenty-six inches in diameter at the top and twenty-four inches in diameter at the bottom. Those remarkable conditions are complied with, as far as power goes, in the Mill Creek plant, which operates under a head of 1,960 feet. This little column of water, which, if liberated, would be just about enough to make a small trout stream, gives a capacity of 5,200 horse-power, or enough power to run a good-sized ocean-going vessel. As the water strikes the buckets of the water-wheel, it has a pressure of 850 pounds to the square inch. What this pressure implies is evidenced by the fact that the average locomotive carries steam at a pressure of 190 or 200 pounds to the square inch. Were this stream, as it issues from the nozzle, turned upon a hillside, the earth would fade away before it like snow before a jet of steam. Huge bowlders, big as city offices, would tumble into ravines with as little effort as a clover burr is carried before the hydrant stream on a front lawn. Brick walls would crackle like paper, and the hugest skyscrapers crumble before a stream like that of the Mill Creek plant. It takes a powerful waterwheel to withstand the tremendous pressure. At Butte Creek, Cal., a single jet of water, six inches in diameter, issues from the nozzle at the tremendous velocity of 20,000 feet a minute. It impinges on the buckets of what is said to be the most powerful single waterwheel ever built, causing the latter to travel at the rate of ninety-four miles an hour, making 400 revolutions a minute. This six-inch stream has a capacity of 12,000 horse-power. The water for operating the plant is conveyed from Butte Creek through a ditch and discharged into a regulating reservoir which is 1,500 feet above the power house. Two steel pressure pipe lines, thirty inches in diameter, conduct the water to the power-house.—The World To-day.

PROGRESS OF THE NEW JERSEY TUNNELS AND SUBWAYS.

The New York public is so greatly interested in the schemes for the further development of the original rapid transit Subways, and in the progress of the Pennsylvania tunnels and terminal station, that it probably fails to appreciate the magnitude of the scheme of tunnels connecting Jersey City traction systems with New York, and the equally important subways beneath Manhattan which form an integral part of that system. Since the amalgamation of the separate companies which originally were constructing, each of them, a pair of tunnels, one at Morton Street, and the other at Fulton and Cortlandt Streets, the work has been pushed along with all the energy and speed which abundance of capital and an energetic administration can command.

The system, as at present being built, consists of a two-track road, placed in two separate 15-foot tubes, which will extend from the Delaware, Lackawanna & Western Railroad terminal in New Jersey, along the shore line to the terminal station of the Central Railroad of New Jersey. At the intersection of the Subway with Fifteenth Street, it will be intersected by twin tunnels, which will extend from Thirteenth, Fourteenth, and Provost Streets, and connect with the two tunnels that have now been opened beneath the Hudson River to the Manhattan side. These two tunnel tracks have been carried beneath Morton and Greenwich to Christopher Street, and they will branch at the junction of Ninth Street and Sixth Avenue, into two separate pairs of tunnels, one of which will extend beneath Ninth Street to Fourth Avenue to a connection with the present Fourth Avenue Rapid Transit Subway. The other branch will extend north below Sixth Avenue to Thirty-third Street, where there will be built a large station of ample size to accommodate the great traffic which is certain to seek this route. At Thirty-third Street, also, the system will be in touch with the Pennsylvania Railroad tunnel across Manhattan Island, and consequently, New Jersey traffic, both on the trunk steam railroads and on the surface trolley lines, will be placed in direct touch with the Pennsylvania tunnels and their extensive Long Island connections, and with the rapid transit system with its many ramifications in Manhattan and Brooklyn.

The Jersey shore line Subway, south of the intersection with the Morton Street tunnels, will tap the Erie Railroad terminal, the Pennsylvania Railroad terminal, and the terminal of the Central Railroad of New Jersey. The downtown tunnels, beneath the Hudson, which will consist, like the rest of the system, of two single tubes with a single track in each, will extend from the Pennsylvania Railroad terminal in New Jersey to a large terminal station, which will be located on the two blocks on the west side of Church Street between Cortlandt and Fulton Streets. These two tracks will diverge from the New Jersey shore, one of them passing below Fulton Street, Manhattan, and the other below Cortlandt Street. The down-town terminal, in addition to the underground tracks, platforms, etc., incidental to a station of this character, will include two twenty-story buildings, one between Cortlandt and Dey Streets, and the other between Dey and Fulton Streets, and the full cost will be approximately ten million dollars. From the station an underground foot passage will be constructed through Dey Street to the Interborough Subway at Broadway, where passengers will be able to make connection with trains for Manhattan and the Bronx and for Brooklyn.

At the present writing the condition of the work is, that on the up-town tunnels the north tunnel is completed from the shaft on the Jersey side to a point where it turns out of Greenwich into Christopher Street, while the south-bound tunnel has been built from Jersey City to a point where the tunnel turns out of Morton into Greenwich Street. The first through connection on the south tunnel was made September 22 of this year, and one of the accompanying illustrations shows the first party to be taken through this tunnel from New Jersey to New York, an event which was celebrated September 29. On the down-town section of the road the work of demolishing the buildings on the site of the Fulton-Cortlandt terminal is being pushed vigorously by the wrecking companies, who are under contract to have at least half of the building removed and the ground ready for excavation within ninety days. The shafts are being sunk, and the two tunnels

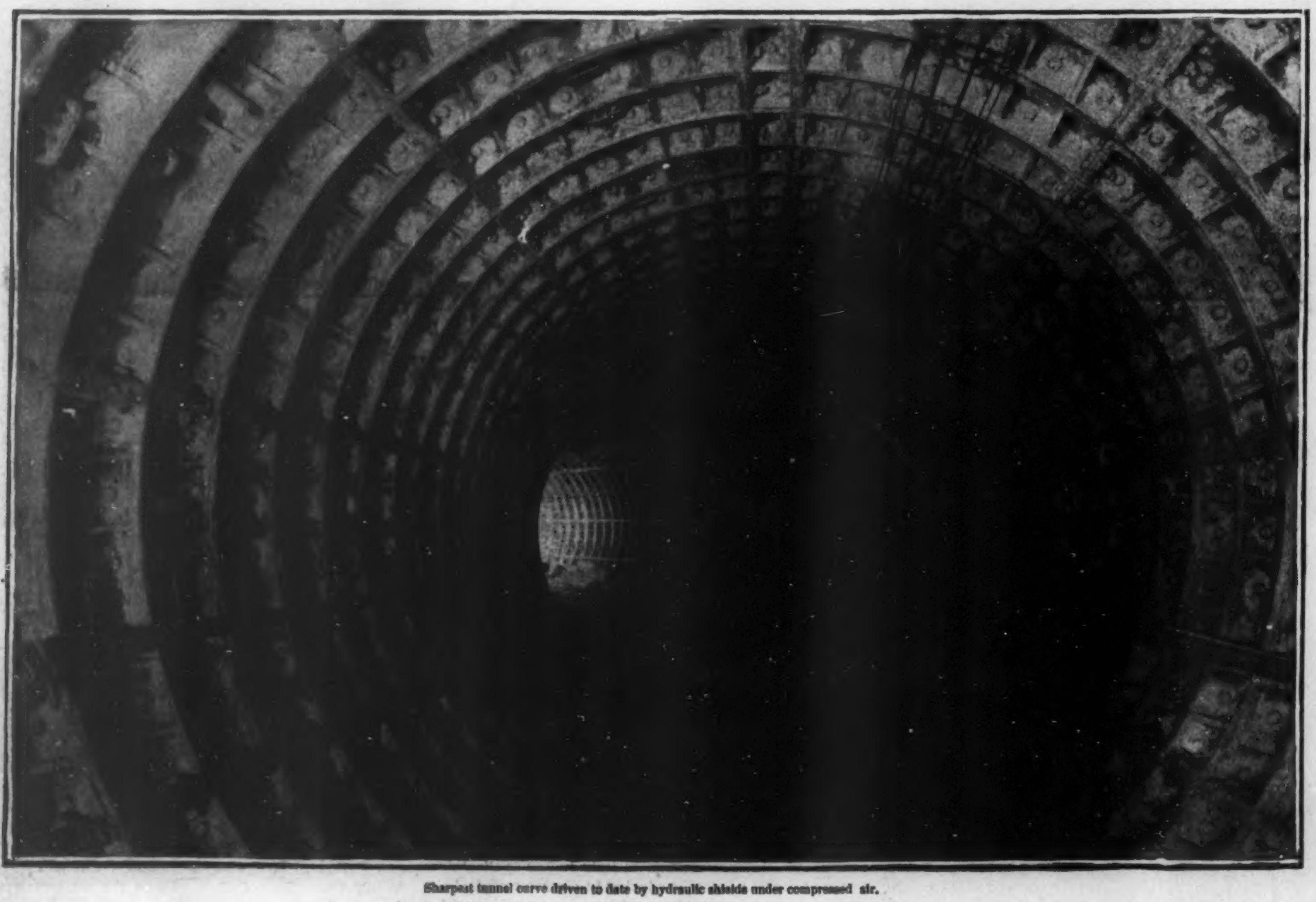
will be driven simultaneously beneath the river. An important feature, showing the excellent character of the work, is the fact that the whole of the Hudson Company's subways, even where they pass through solid rock, will be excavated by the shield method, and finished throughout with iron segmental lining.

The most striking photograph of those which we show is that of the interior of one of the finished tunnels at Morton and Greenwich Streets. This section was built through a sand and gravel formation, and the curve was driven by the same hydraulic shield that was used on the tangents and by the same compressed-air method. It had been freely predicted that it would be impossible to preserve correct alinement when using the shield method on a curve of such sharp radius, and the Chief Engineer, Mr. Charles M. Jacobs, and his staff of assistants in charge of this work, are to be congratulated upon the fact that the two tunnels driven on two concentric arcs of circles, although there was no direct communication between the two, were maintained in such exact alinement, that there was practically no variation in the distance between their centers throughout the whole sweep of the curve. The construction of these curves involves some nice instrumental work, and the diagram and description will explain how this is done.

A precise traverse line is first surveyed in each tunnel and joined at a common point, which is located in the east-bound tunnel near the brick bulkhead. This precise line has been connected with the surface survey by means of one plumb line down the shaft and a second line down a pipe located on Morton Street near Greenwich Street. The co-ordinates of all transit points were then computed. All measured distances are corrected for the horizontal position of tape and for temperature effects. All angles are repeated at least forty times by two different men. The angle at the point common to the two traverse lines was observed a large number of times, for upon the correct-

One of the Tunnel Air-Locks.

Break Through the Brick Wall in South Tunnel, Dividing Old from New Work.



Sharpest tunnel curve driven to date by hydraulic shields under compressed air.

Tunnel Curve of 150-foot Radius at Morton and Greenwich Streets.

View Beneath the Apron Used in Front of Shield in Removing Rock Obstructions.

An Emergency Lock for Tunnel at Pier C.

Trip of First Party to Pass Through South Tunnel, September 29, 1905.

PROGRESS OF THE NEW JERSEY TUNNELS AND SUBWAYS.

ness of this angle depend the relative positions of the two tunnels.

The method by which the position of any ring is obtained with reference to its correct position can best be described by reference to the accompanying sketch. In the sketch *C* is the center of the curve, *A* and *B* are transit points in the tunnel on the traverse line. When the position of a ring with reference to the true center line is to be obtained, a transit set at *A* is sighted to *B*, and the intersection of this line with the leading edge of ring marked, and the distance measured from *A* to *D*. Knowing the distance and bearing of line *C A*, and bearing of *A B* and the measured distance *A D*, the side *C D* is computed; by taking the radius from this length and offset, *O* is determined.

The centering bar is then placed in the leading flange of the ring, and the distance from center of ring to point *D* read with the transit at *A*. This measured offset should equal the offset *O*, and any variation from this is the error of position of the ring as erected. The angle at *D* is computed, and a transit set at this point back-sighted to *A* and angle turned. With the telescope in this position, pointing to the center of curve, the offsets *N* and *S* to the face of the ring are then measured, and their sum gives the "lead" of the iron. If this "lead" is fair, these offsets will be zero. All important points in the precise line are continually being checked, and every care possible taken to have accurate work.

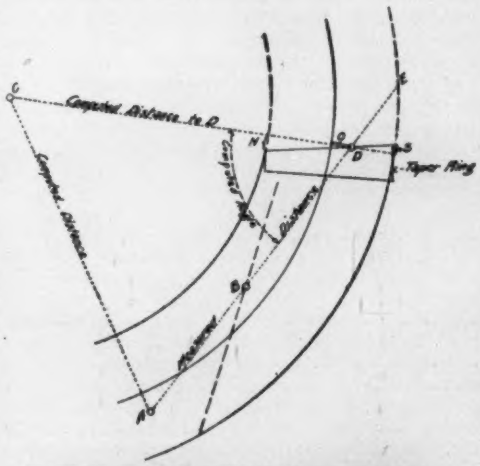


DIAGRAM SHOWING METHOD OF INSTRUMENTAL WORK IN BUILDING TUNNEL ON CURVE.

THE LIFTING POWER OF A SCREW PROPELLER FOR AERONAUTICAL WORK.

Among the various schemes proposed for a practical flying machine is that in which one or more horizontal propellers are used to lift the machine while other vertical propellers afterward drive it forward. Some time ago two well-known French aeronauts—Messrs. Louis Goddard and Felix Faure—conducted experiments with horizontal propellers having two or more blades, the object in view being to determine how much could be lifted and what was the most efficient propeller. Starting with a six-bladed propeller driven by foot power from a specially-rigged bicycle frame (with which an upward pull of 3 kilogrammes, or 6.6 pounds, was obtained) the experimenters kept diminishing the number of blades with constantly-improving results. A four-bladed propeller gave 7 kilogrammes (15.4 pounds) lift, and, finally, with an ordinary two-bladed propeller, this lift was doubled. As this was about the limit with an apparatus propelled by pedaling, a 1¾-horse-power gasoline motor was next used as the propulsive force. With this the lift was quickly raised to 23 kilogrammes (50.69 pounds). Next, a more efficient screw designed by the well-known constructor of aeronautical apparatus, M. Hockengjos, was employed, and with this 30 kilogrammes (66.13 pounds) was lifted, or almost one-half the weight of the entire apparatus.

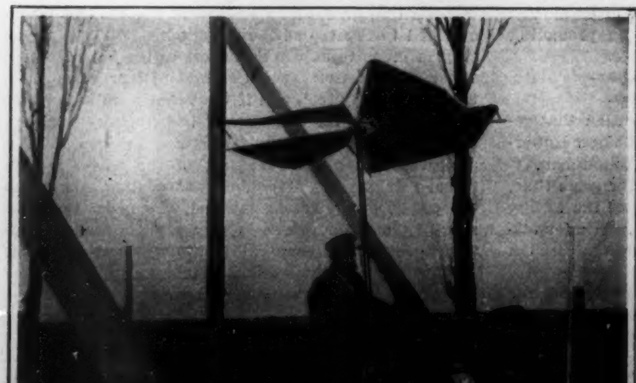
The third attempt was made with a Postel-Vinay electric motor as the motive power. The weight of the whole machine was reduced to 70 kilogrammes (154 1-3 pounds) and the lifting power was increased to 75 kilogrammes (165 1-3 pounds); so that the inventors at last had the pleasure of seeing their creation raise itself. By modifying their device somewhat, so that the blades were given a reciprocating motion and made to beat the air by means of eccentrics, and also by adding another smaller propeller, revolving in the opposite direction, the machine was at length made to lift as high as 100 kilogrammes (220 pounds) with an expenditure of 8 to 10 horse-power. This corresponds to a lift of over 20 pounds per horse-power; and, as gasoline motors are now constructed weighing not over 5 pounds to the horse-power, it is apparently quite practical to construct on this principle a machine that will actually fly. It is interesting to note that this apparatus was constructed on somewhat the same plan as that outlined by Mr. S. D. Mott in an article in Supplement, No. 1399. Other experiments along this line by the Dufaux brothers, in which these results were scarcely equaled, however, were described recently in our issue of October 21, 1905.

The Second Experimental Apparatus, Which Was Propelled by a 1¾ Horse-Power Gasoline Motor.

The first propeller tried with this apparatus lifted 50.69 pounds and a more efficient one designed by Hockengjos raised 66.13 pounds.

The Aeronautical Experimenters Grouped Around Their Second Apparatus.

The man in the blouse is Louis Goddard, and the other two men to the right are M. Hockengjos, airship constructor, and M. Felix Faure, the inventor of the apparatus, which is called the "Autovolant."



Aeronaut Louis Goddard Pedaling the First Experimental Six-Bladed Propeller with Which a Lift of 6.6 Pounds Was Obtained.

The Final Apparatus, Which, Driven by a 10-Horse-Power Electric Motor, Raised 220 Pounds.

The propellers are 6½ and 8½ feet in diameter and they revolve in opposite directions at 300 and 250 revolutions per minute respectively, the lower one having besides an arrangement for giving a flapping movement to the blades. Steel ribbons were used to brace the propellers, as piano wire was not strong enough.

THE LIFTING POWER OF A SCREW PROPELLER FOR AERONAUTICAL WORK.

A NOVEL METHOD OF DOG-SHEARING.

Considerable surprise has recently been caused on the banks of the Seine in Paris, by the appearance of a perambulating outfit for shearing dogs, a practice quite generally in vogue in the French capital. The accompanying engraving clearly illustrates this enterprising institution. It consists of the usual mechanically-operated shearing apparatus, a small 2½-horse-power gasoline motor to drive the former, and a rough carriage on wheels, upon which the motor and the other mechanism are mounted. By means of this outfit six dogs per hour can be sheared, and it is said that the originator of this peripatetic business is making a decided success of it. There seems to be little doubt that before long this means of dog-clipping will be generally adopted.

Los Angeles's Giant Water Scheme.

One of the most extensive projects for securing a water supply as well as electric power which has yet been outlined by engineers, is a plan by which the city of Los Angeles will obtain water in future for domestic purposes. As is well known, the question of water is one of the most important in the West and Southwest, owing to the climate and topography of the country. At present Los Angeles depends upon a single water course. The volume from this stream is sufficient for the present needs of the people, but the city authorities have determined to obtain sufficient for an indefinite period. The engineers called into consultation have made a thorough investigation of the various streams and lakes in Southern California, and have decided that the most practicable for the purpose intended is located in Inyo County. Inyo County includes Owens Valley, which the river of this name traverses. The watershed embraces about 2,000 square miles in area, capable of furnishing a volume of water from which a flow of 600 cubic feet per second can be supplied continuously when the storage system is completed.

The watershed in question, however, is located in the extreme eastern section of the State, so that it will be necessary to construct a conduit over 200 miles in length. The exact distance estimated by the engineers is 209 miles. When completed this will be probably the longest conduit of its kind in the world, the only one approaching it in length being a canal constructed in the Coolgardie mining territory of Australia. The distance in a straight line from Los Angeles to the valley of Owens River is 175 miles, but the route will make a considerable detour in order to avoid ranges of mountains which form the western side of the valley. As it is, however, no less than ten miles of tunnels must be constructed in order to complete the work, while for a considerable distance the conduit will be built upon an elevated structure of concrete or other supports.

This notable aqueduct will be fourteen feet in width and of dimensions sufficient to deliver the quantity of water referred to when necessary—600 cubic feet per second. It will be supplied from a reservoir which will be constructed across the Owens River at a point some distance from its mouth, where a dam can be constructed at a minimum expense. Already the city has secured the necessary riparian rights, and work upon the reservoir will be begun in the near future. The project is of such magnitude, however, that it is estimated fully five years will be required to complete the conduit and reservoir, and the terminals in the city. The conduit itself will be composed of concrete.

As already intimated, the city will not only secure a water supply, but also a very extensive horse-power for manufacturing and other purposes. As the valley of Owens River is at a considerable elevation above Los Angeles, no pumping stations will be needed. As a matter of fact, the elevation of the valley is no less than 4,200 feet. It is calculated that with a volume of water averaging 600 feet a second flowing through a conduit of the dimensions referred to, fully 60,000 horse-power can be obtained. This will be utilized for generating electric current through a series of turbines connected with the necessary electrical units. Consequently one of the greatest advantages, aside from the ample supply of water for domestic purposes, will be cheap power. As is well known, Los Angeles is the center of several important interurban electric lines, while it has probably a greater mileage of trolley lines within its limits than any community of its population in the United States. It is intended to employ this current largely for transportation purposes, although a considerable horse-power will be available for manufacturing as well as illumination, if desired.

The cost of the system is estimated at $23,000,000, but it has met with such favor that already arrangements have practically been made by which bonds for this amount will be taken at 4 per cent interest. The cost of securing the riparian rights was $1,500,000. The question of raising this sum was decided at a recent election, when the vote in favor of it was almost unanimous. At present the city requires a flow of about 80 cubic feet per second for domestic purposes, consequently with the proposed system it will have over seven times the volume needed at present, but as in the case of New York the people have decided to provide for the future, and it is calculated that the valley referred to will be sufficient for the requirements of a million population. Compared with other waterworks systems of magnitude, that of Los Angeles is far greater than any other in the world, considering the number of its inhabitants.

Hitherto the water of Owens River has been used chiefly for irrigation purposes, and in this connection some interesting statistics have been compiled by the engineers showing the value of a certain quantity applied in irrigating various crops. For example, one and one-half miner's inches are required to grow an acre of alfalfa in the valley. The yield of an acre in a season averages about six tons, one inch of water producing four tons. The growers secure about $10 per ton, consequently the returns from an inch of distribution net $40 in a season. It has been found, however, that in the vicinity of Los Angeles one inch of water is sufficient for five acres of orange trees. The average harvest of this area represents from 1,200 to 1,500 boxes of fruit, which in an ordinary season sell at a rate of $2.25 a box. Therefore the use of the water for orchard irrigation is of enormous value compared with the irrigation of the alfalfa field. As the percentage of surplus water will be very large for a long period, it is intended to utilize this for irrigation in Southern California, so that while the cost of obtaining it will be very large compared with the water supply usually furnished American communities, the returns from the sale of electric power, of irrigation rights, and for domestic use, it is calculated will well repay the outlay incurred. The city authorities have been encouraged in carrying out the plan by the Chamber of Commerce of Los Angeles, which has been active in promoting the scheme.

A NOVEL METHOD OF SHEARING DOGS.

Spontaneous Ignition of Piles.

A remarkable case of spontaneous ignition that recently occurred in erecting the walls of the new Rotterdam quay is related by the Technische Rundschau.

Morrison rams had been in use there for some time, which by 180 to 200 strokes per minute of the falling ram caused a steady advance of the piles. The foundation was such that the pillars had to be driven through the quicksand down to the solid ground.

On withdrawing some piles, the points of the latter were found, owing to the enormous friction, to have been charred entirely and heated to such a point as to begin burning spontaneously on coming in contact with the air; nor could iron shoes prevent this spontaneous ignition.

It may be said that when leaving the piles in the ground this ignition would not result in any damage, the charring remaining confined to the surface, and the heat being rapidly carried away in the moist surroundings.

The British zoological gardens have recently acquired two specimens of the rare talapoin monkey. The talapoin, which receives this name owing to its fancied resemblance to a Siamese priest, is the smallest of the group of green monkeys (so called from the general olive tint of the fur) and is about the same size as a squirrel. The head is round, with large ears, the face is brightly colored, the naked skin around the eyes is orange, and the upper lip and drooping whiskers straw-yellow.

THE SALMON FISHERIES OF THE NORTHWEST.

BY DAY ALLEN WILLEY.

The "run" of the salmon in the waters of streams entering the Pacific Ocean in the Northwestern States corresponds to a certain extent to the movements of the shad from the Atlantic up such rivers as the Hudson, the Susquehanna, and southern watercourses. The Pacific salmon, however, is much larger in size, and, as is well known, forces its way to the headwaters of the stream which it enters, frequently overcoming a very swift current and leaping up waterfalls six feet and more in height.

It has been demonstrated by experiments made by the United States Fish Commission that the salmon hatched out on a certain watercourse always returns to it or to an adjacent watercourse after maturity, and apparently endeavors to reach the locality of its first home. Fish which have been marked to identify them have been found in or near the waters which they left before reaching maturity. Frequently the salmon is so exhausted by the journey upstream, which is sometimes hundreds of miles in length, that it floats into shoal water and dies if it is not captured. During the season of the salmon run, it is a fact that some of the creeks in the State of Washington connecting with the sea have been so filled with dead and dying fish that the waters were polluted for the time being.

Advantage has been taken of this habit of the salmon to catch it with a device which is decidedly unique in its construction and operation. It might be termed an automatic net, since it not only catches the fish, but delivers it into the receptacle from which the salmon is taken to be prepared for market. The net is employed principally upon the Columbia River, where hundreds are in use, especially in the vicinity of the Dalles and above this formation. As the wheel is operated entirely by the current of the river, it must be placed where the movement of the water is sufficiently rapid to revolve it. The salmon wheels are of two kinds, one having a movable base and the other fastened to the shore or to cribwork projecting from the bank. The shore wheels are by far the largest, some of them being fully fifty feet in diameter. As the illustrations show, they are not perfectly round, but consist of a framework, which is usually divided into three or sometimes four sections. This framework is composed of light but tough wood, the sides covered with stout wire netting reinforced with bands of iron. The rim of each section is also covered with the same material, with the exception of a space which is left entirely open. The wheel revolves in the usual manner upon an axle, but in each section is placed a wooden trough. This trough is set at an angle, and projects about a foot or so from the side of the wheel, its lower end being directly over another trough which leads to the fish collector. This may be a box or merely a platform.

The wheel is suspended in a stout framework, each end of the axle being set in grooves, so that it can be moved up or down by the use of a block and tackle attached to the top of the framework. This is necessary in order to adjust the wheel to the height of the water, for at times the Columbia River rises from twenty to thirty feet, and if the wheel were immovable it would be too far under water to be of service. Consequently, the apparatus is raised or lowered to such a degree that about four feet of the wheel is continually submerged, the submerged portion acting like the paddle of a steamboat wheel. To resist the pressure of the water, which is very great, especially during flood time, the framework into which the wheel is set is built of heavy beams bolted together, and anchored to the shore not only by other beams, but frequently by steel cables, where the apparatus is not set into a fishway.

As the wheel revolves in the water, each of the compartments into which it is divided is successively submerged, the motion of course being downstream. The salmon in their ascent, going in the opposite direction, strike the rim of the wheel as it revolves, or pass into one of the compartments. If they hit against the netting and fall away from it, they drop into the opening, as each projects beyond the netted portion of the rim. As the wheel turns, the imprisoned fish are swung around with it, and drop into the trough in the bottom of the compartment. Through this they slide into the larger trough, and then also by gravity are deposited in the fish collector.

When the fish are thrown into the collector, they are taken out by hand and killed and cleaned on the platform or in the shed, which may be built near at hand. A few strokes of the knife remove the head and entrails, when they are ready to be packed and sent away or sold to a local buyer. The killing and clean-

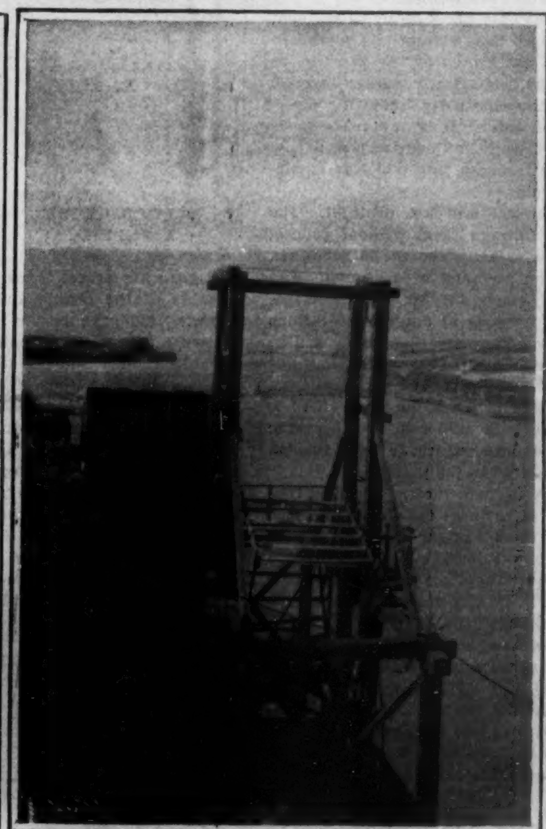
ing room is provided with a trapdoor, through which the refuse is dropped into the river.

The floating wheels are usually attached to the end of a scow, and while similar in shape and construction, are really considerably smaller than the shore wheels. They are attached to the scow by means of beams, which extend from a point beneath the axles to the deck. The beams move in sockets, and are held in position by wire ropes or cables, leading over a framework on the foredeck of the scow, winding on hand windlasses. By means of the cable system the wheel can be raised and lowered, and thus adjusted to the depth of water. The scow is anchored or moored to the shore, with the wheel end projecting downstream. Consequently, the wheel must be revolved by the current which flows underneath the craft, and the rim usually is placed about four feet lower than the bottom of the scow, in order to secure enough momentum. The scow is provided with a cabin, which forms the living quarters of the crew, sometimes a shed for cleaning, although this work is frequently done upon the dock itself.

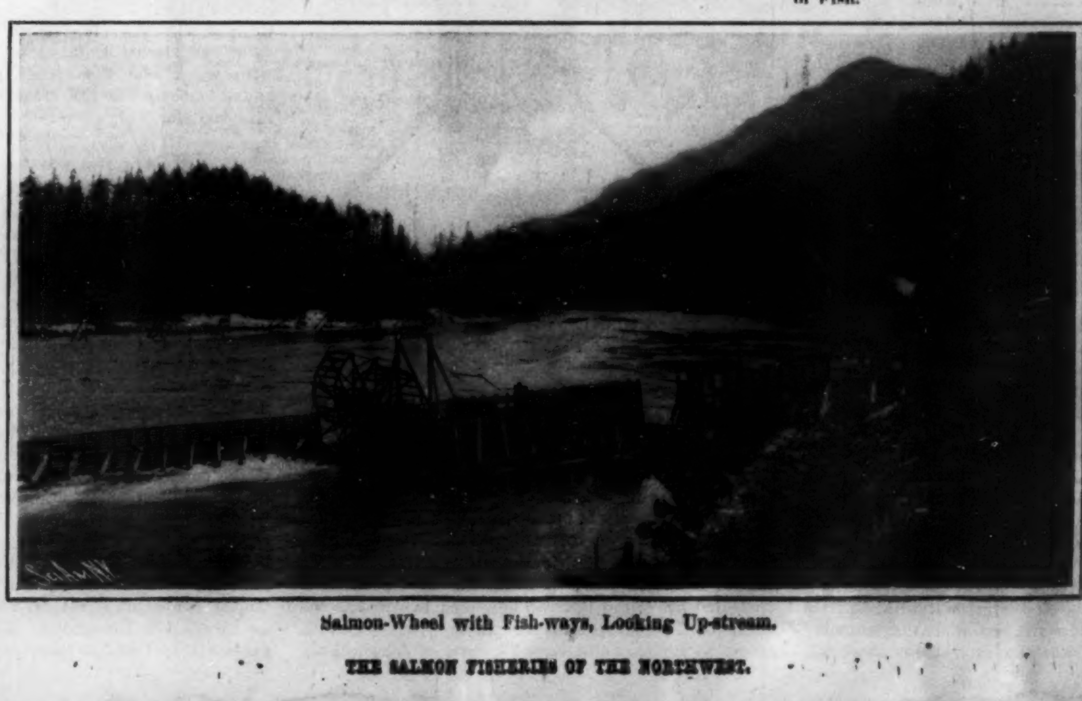
Such is the number of fish passing up the river during the "run" season, that from a single wheel fifty tons have sometimes been taken in twenty-four hours, as the fishing can be carried on at night by means of artificial illumination. It is a fact that some of the larger companies, maintaining a dozen or more wheels alongshore, have an electrical system by which each wheel is illuminated by arc lamps. On the Columbia the wheels are sometimes termed the "wheels of fortune," by reason of the profits which are derived by the individuals and companies owning them—some of the wheels earning from $500 to $1,000 in a day. Advantage is taken of localities where points jut out into the river, the wheel being set at the extremity of the point. Usually a leadway for the fish is built on the river side of the wheel, so that the course of the salmon which come upstream between the end of the leadway and the shore is diverted to the wheel. Where the shore line is but little curved, however, fishways are built supported by cribs of stonework, and the fish wheel set into the crib, as shown by the accompanying illustration. Until recently some of the leadways reached so far across the open river that the passage of the fish was almost prevented. This resulted in a law being passed, allowing the ways to be constructed only for certain distances and in certain directions. As it is, however, the run of the salmon has been decreasing from year to year, and is now of small proportions compared with the numbers which ascended the Columbia ten years ago. Fishermen say that this is true of nearly all of the streams frequented by the fish in Washington and Oregon.

How the Floating Salmon-Wheel is Attached to the Barge.

End View of Salmon-Wheel, Showing the Nets.



The Rim of the Wheel is Open to Allow the Entrance of Fish.



Salmon-Wheel with Fish-ways, Looking Up-stream.

THE SALMON FISHERIES OF THE NORTHWEST.

The argument that small quantities of deleterious substances as preservatives of food may be used without harm is not logical, nor can it be based upon the result of experiment. The use of boric acid and equivalent amounts of borax should be restricted to those cases where the necessity therefor is clearly manifest, and where it is demonstrable that other methods of food preservation are not applicable, and that without the use of such a preservative the deleterious effects produced by the foods themselves by reason of decomposition would be far greater than could possibly come from the use of the preservative. As a matter of public information, and for the protection of the young, sick, and the debilitated, each article of food should be plainly labeled and branded, so as to show the character and quantity of the preservative employed.

The Utilization of Peat in Germany.

BY ARTHUR F. BALL.

The inventors of most known processes of briquetting peat have attempted to treat the raw peat by means of pressure. In only two processes is the peat coked. Doubtless the briquettes produced are much better than the ordinary dried peat, and possess a far greater calorific power and specific gravity. But the use of such briquettes has been confined largely to the places of their manufacture, because of the expense of transportation and of the impossibility of successfully competing with coal in localities where coal is readily obtained. Even in Germany, which may well be regarded as the home of the briquetting industry, such peat briquettes have been displaced by other forms of artificial fuel. Of the two processes for coking peat referred to, one has already failed because of the expense incurred in evaporating the moisture in the peat before coking. The only process which has at all succeeded is the Ziegler process, which it is my purpose to describe in this article.

The purpose of this process is to convert the peat, which contains 90 to 95 per cent of moisture, into a good, compact, smokeless fuel. All the products which are contained in the peat itself are recovered, and all the heat generated is utilized, thereby avoiding the necessity of using any other fuel. The process is, therefore, continuous and self-sustaining.

The peat is assembled in the usual manner by the ordinary peat machines which mold and press the peat into squares. The peat is then allowed to dry in the open air until it contains only about 50 or 60 per cent of moisture. The product thus obtained is placed in drying chambers which are heated by the burnt gases from the furnaces. The peat slowly passes through these chambers and emerges quite dry, but still containing 20 to 25 per cent of water. It is now ready to be coked. By means of endless belts the dried peat is conveyed to the top of the furnaces, into which it is conveyed at regular intervals.

The furnaces are vertical and are air-tight. The peat, therefore, passes through them without coming into contact with the outer air. The gas is generated by the distillation of the peat and used as fuel. The products of distillation, namely, tar, tar water, and gas, are drawn off from the furnaces at different elevations by means of exhausters. They are then condensed so that the tar is separated from the tar water and gas. After passing a water-sealed valve, the gas is allowed to enter the furnaces and is there burned. There is an excess of gas, and this is used either to heat the boilers or to drive gas engines, which, in turn, furnish the necessary power required in the process.

From tests made in a German factory it seems that one ton of peat (90 to 95 per cent moisture) produces 700 pounds of coke, 800 pounds of tar water, 80 pounds of tar, and 420 pounds of gas (6,650 cubic feet). From the 800 pounds of tar water there are obtained 8 pounds of ammonium sulphate, 12 pounds of acetic acid, and 12 pounds of wood alcohol.

The tar is used in Germany for the impregnation of wood. The coke constitutes a very valuable fuel in large iron and steel factories. The dust from the coke is bought by the Russian and German governments and manufactured into smokeless fuel briquettes by a secret process, which briquettes are used on war vessels. Something of the comparative calorific power of this fuel and of other fuels can be gathered from the following table:

Wood	5,760	B. T. U.
Ordinary peat	6,840	"
Pressed peat	7,290	"
Bituminous coal	11,000	"
Ordinary gas coke	12,060	"
Peat coke	12,676	"
Semi-bituminous coal	13,000	"
Charcoal	13,804	"
Anthracite	14,600	"

The comparative compositions of peat, coke, and charcoal are given by the following table:

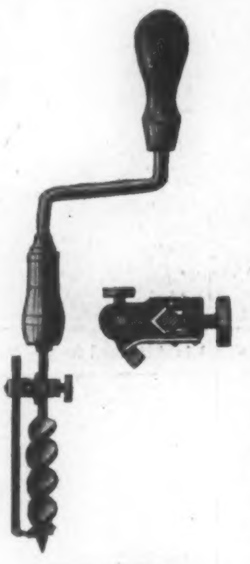
	Coke.	Charcoal.
Carbon	84.23	85.18
Hydrogen	1.93	2.88
Oxygen	6.28	3.44
Water	4.47	6.04
Ashes	3.09	2.46
Sulphur		
Nitrogen		

Each furnace is so constructed that in twenty-four hours there are produced from 33,333 pounds of peat (20 to 25 per cent moisture) about 11,668 pounds of coke, 13,333 pounds of tar water, 1,333 pounds of tar, and 6,999 pounds of gas (110,833 cubic feet).

A new type of bullet, known as the "D," is being served to the French infantry. This projectile consists of a cigar-shaped cylinder of bronze, instead of lead, and is cased with nickel, as is the old Lebel bullet. On being fired it revolves at the rate of 3,600 turns a second during its flight. At 800 yards it will penetrate the equivalent bulk and resistance of six men standing one behind the other. The new cartridge is absolutely smokeless. All the Lebel rifles of the French infantry are being refitted for the "D" bullet with fresh sights up to 2,400 meters.

DEPTH GAGE FOR BRACE BITS.

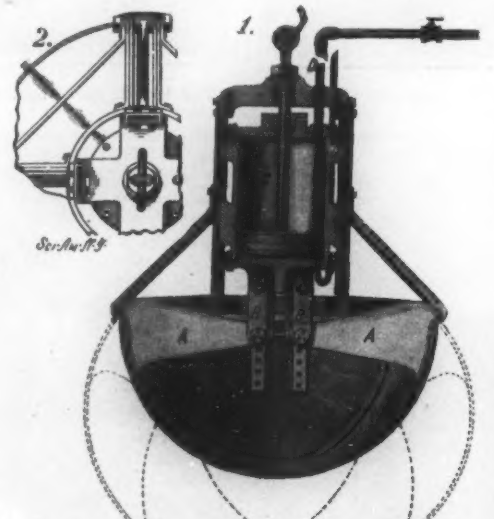
The occasion often arises when it is desirable to drill a hole or a number of holes of a certain definite depth; but with the ordinary tools no means are provided for determining to what depth the drill or bit has penetrated. Mr. Edward J. Tiede, of 433 Johnson Street, Buffalo, N. Y., is the inventor of a simple attachment for bits, which will accurately gage the depth of the bore. This gage may be set to a certain mark and the hole drilled until the gage is reached, or the device may be used at any time to measure depth of the hole. The attachment consists of a simple clamp, which may be applied to the shank of the bit, and a gage bar adapted to be adjusted in this clamp. As shown in one of the engravings, the clamp is composed of two members hinged together at one edge, and adapted to be closed onto the shank of the bit. The members are held in this closed position by a spring latch, which snaps over a pin. By means of a thumb-screw threaded through one of the members and bearing against the shank, the clamp may be secured at any desired height on the bit. The gage bar passes through an opening in the other member of the clamp, and is fastened by a thumb-screw. This gage bar is graduated to inches, centimeters, or any other desired measure. The clamp should be so set that the zero mark of the scale comes in line with the upper face of the clamp, while the lower end of the bar reaches to the end of the bit. Then, if it is desired to drill a hole of say two inches depth in a block of wood, the gage bar would be raised until the two-inch mark came in line with the top of the clamp, and the brace would be operated until the end of the gage bar touched the surface of the wood. By keeping the gage at the proper adjustment, any number of holes of equal depth may be bored. The principal advantage of the attachment lies in the ease with which it may be applied to or removed from the bit shank.



DEPTH GAGE FOR BRACE BITS.

AN IMPROVED EXCAVATOR.

We illustrate in the accompanying engraving a recently invented excavator, which is of the sectional bucket type. The excavator has a very simple construction, and is provided with improved operating mechanism. It will be noted that no chains, or similar devices, are used for operating the bucket. Our illustration shows a section view of the excavator with the bucket in closed position, while the open position is indicated by dotted lines. The closed bucket has the form of a hemisphere comprising four segments. These segments, which have the form of spherical triangles, are pivoted at their outer edges to brackets extending from the frame of the excavator. Each segment carries a pair of arms *A* (shown also in the plan view, Fig. 2) and these are connected by means of links *B* to a cylinder *C*. The cylinder is formed with laterally-disposed lugs, which are received in channels or guides on the main frame of the device. This arrangement permits of vertical movement of the cylinder, to provide for the opening and closing of the bucket segments. Within the cylinder is a piston head carried on a piston rod, which extends through a crosshead at the top of the main frame. A nut on the piston rod rests on the crosshead, so that the piston head is suspended therefrom. The excavator is lifted by a cable attached to a bail on the crosshead. In use the excavator is lowered into the water, with the bucket open, as shown by dotted lines in Fig. 1. The segments naturally assume this position, as the cylinder slides by gravity down the tracks until it rests on the piston head. Then to close the bucket a valve is turned, admitting steam into the cylinder through the pipe *D*. The steam acting between the stationary piston and the upper cylinder head causes the cylinder to rise to the position shown in full lines in the engraving, and thereby closes the bucket. A small vent pipe at the lower end of the cylinder permits escape of the air below the piston. To open the bucket again, the valve is turned to permit escape of the steam from the cylinder, when the latter will drop to open position. A patent on this improved excavator has just been granted to Mr. W. H. Onion, 2518 Canal Street, New Orleans, La.



AN IMPROVED EXCAVATOR.

Official Meteorological Summary, New York, N. Y., November, 1905.

Atmospheric pressure: Mean, 30.04; highest, 30.59; lowest, 29.52. Temperature: Highest, 63; date, 29th; lowest, 19; date, 30th; mean of warmest day, 56; date, 29th; coldest day, 30; date, 14th; mean of maximum for the month, 51.1; mean of minimum, 36.6; absolute mean, 43.8; normal, 43.7; average daily excess compared with mean of 35 years, +0.1. Warmest mean temperature for November, 50, in 1902. Coldest mean, 37, in 1873. Absolute maximum and minimum for this month for 35 years, 74, and 7. Average daily deficiency since January 1, —0.1. Precipitation: 1.67; greatest in 24 hours, 1.42; date, 28th and 29th; average for this month for 35 years, 3.52; deficiency, —1.85; deficiency since January 1, —0.44. Greatest precipitation, 9.82, in 1889; least, 0.82, in 1890. Snow, trace. Wind: Prevailing direction, N. W.; total movement, 10.271; average hourly velocity, 14.3; maximum velocity, 48 miles per hour. Weather: Clear days, 11; partly cloudy, 13; cloudy, 6.

A New Process of Regenerating Rubber.

A European process for regenerating old rubber has for its principle the separation of the caoutchouc proper contained in vulcanized rubber from the mineral and other matter which have been incorporated into it, such as sulphur, etc. The first operation consists in dissolving the vulcanized rubber in one of the usual solvents, using petroleum preferably either alone or with benzine added to it. After treating for a certain time the insoluble matter is separated by filtering under pressure, or by a centrifugal machine. The solution when separated from the insoluble matter is evaporated to the consistence of syrup under a reduced pressure and is then taken up by acetone. The liquid which is thus obtained is first boiled and then decanted off and the rubber is again taken up by an alcoholic soda solution. After boiling and pouring off a second time, the rubber is treated with boiling alcohol. After the alcohol is taken off, the rubber is washed with water and then dried by superheated steam, which removes the last trace of alcohol and water it may contain.

The Current Supplement.

The current Supplement, No. 1562, opens with what is perhaps the most exhaustive article which has thus far appeared on the electrification of the New York Central's terminal lines. The article is elaborately illustrated with views of power houses, stations, rolling stock, and track construction. Of interest to the amateur mechanic is an article on lathes. Mr. Ernest A. Dowson, whose name will ever be associated with the development of producer-gas, recently read a paper before the Birmingham Association of Mechanical Engineers on "The Use of Gas for Power and Heating." This paper may be considered an authoritative exposition of a most important subject. The first installment of the paper appears in the current Supplement. Mr. R. von Lendenfeld discusses the relation of wing surface to weight, a subject of immense importance to aeronauts. The construction of a reinforced concrete power house is described. An interesting radial snow-plow has been invented, which is particularly effective on the curves of street railways. This snow-plow is described and illustrated. The usual formulæ and notes will be found in their accustomed places.

RECENTLY PATENTED INVENTIONS.

Electrical Devices.

ELECTRIC GENERATOR.—M. SCHWARTZ, New York, N. Y. This invention relates to electric generators, such as dynamos. The general object of the invention is to produce an economical conversion of energy into electricity. The inventor accomplishes his object by using inclined pole pieces and inclined or helical windings for the armature. In this way the drag on the armature is exerted in an inclined direction. One component of this inclined force is parallel to the shaft and the other at right angles to the shaft. This latter force is the only substantial resistance to the rotation and is less than that developed by an uninclined winding. The force parallel with the shaft is also taken advantage of to reduce the frictional resistance by supporting part of the weight of the armature, the dynamo being constructed with a vertical shaft.

Of General Interest.

BOTTLE-CLOSURE.—H. A. OLSSON, New York, N. Y. The principal object of this inventor is to provide means for effectually closing the tops of bottles and other receptacles, and while it is capable of general use it is especially adapted for use on milk-bottles. He comprises means for effectually closing bottles and also for protecting the interiors from the entrance of dirt and the like, the whole device being formed in such a manner as to render it inexpensive and easily constructed and employed.

MINER'S LAMP.—D. E. HERRON, New Philadelphia, Ohio. The miner's safety depends always upon his lamp, and this one has several advantages. It may be removed from the support for the purpose of cleaning or filling without removing the cap, since the grooves will always guide the point of the hook into the opening. A V-shaped opening in the front of the support assists this guiding movement. When engaged in the opening, the catch by engaging the barb prevents withdrawal of the hook, and the lug engaging the apex of the V-shaped opening prevents sidewise movement of the lamp. It is impossible to lose a lamp provided with this improvement.

CALCULATING DEVICE.—C. M. YOUNG, San Francisco, Cal. The principal objects in this improvement are to provide a simple and accurate calculating device and more particularly one performing the operation of multiplication. The device may be used either to impress the values of products of factors upon the minds of pupils, facilitating their learning of multiplication-tables or for performing more complicated calculations.

Household Utilities.

SLIDING DOOR.—J. S. SCHLOSSER, Hillsdale, Mich. The inventor particularly embodies the novel construction of a track upon which the door-supporting rollers move, the object being to so arrange the parts that upon sliding the door toward opening position it will be swung outward with relation to the building, car, or other structure to which it may be attached, thus preventing the scratching or marring of the surface of the building, car, or the like, and, further, to provide for a tight or close contact of the door against the building when in closed position.

SLIDING-DOOR HANGER AND MEANS FOR MOVING THE DOOR.—H. C. PERCY, Natchitoches, La. The invention relates to an improvement in hangers for car-doors, and more particularly to the manner of hanging such doors and operating them, whereby they may be more expeditiously and easily opened and closed than is possible with the ordinary method of hanging doors in common use. The invention consists, broadly, in the combination, with a door, of a device rotatively mounted on said door and engaging with its periphery a track, whereby its revolution will cause the door to travel forwardly or backwardly on said track.

Machines and Mechanical Devices.

OIL-CLOTH-PRINTING MACHINE.—W. H. WALDRON, New Brunswick, N. J. The invention relates to machines for imprinting designs in various colors upon oil-cloth and other fabrics by the use of intermittently-reciprocating printing-blocks. The object is to provide a machine for printing oil-cloth arranged to insure a positive locking of the intermittent driving mechanism for the color-trough, to cause an easy driving and locking of the said mechanism without shock or jar, to allow convenient adjustment or detachment of the printing-blocks, and to reduce weight of color-trough to a minimum.

APRON-GUIDE FOR MANGLES.—P. E. BRADLEY, Jersey City, N. J. In this patent the invention relates to the guiding of aprons used on laundry machinery, such as mangles. The object of the invention is the provision of improved means for preventing the aprons from creeping laterally upon their rollers. The application of the invention in no way interferes with the normal operation of a mangle.

Prime Movers and Their Accessories.

AUTOMATIC CURRENT-MOTOR.—J. ROEH, Spokane, Wash. The improvement refers to automatic current-motors to be used for utilizing the power of moving currents, such as those for streams and rivers. It concerns itself especially with that type of current-motor which contemplates the use of a vane carried in the water and operating so as to be automatically tripped to reverse its position upon its sweep. The object is to simplify and improve construction of the tripping mechanism with a view to giving the same a desirable flexibility.

MULTIPLE-CAR LOCOMOTIVE.—J. J. TROEGER, Chicago, Ill. One object of the inventor is to overcome previous faults, by connecting all wheels of the car with the locomotive in such a manner that each of the wheels is a driving-wheel. Consequently addition of more load to cars only makes the drive-wheels press upon rails with greater force, and so provides for the more ready propulsion of the train, provided there is sufficient power. Moreover, instead of making the engine sufficiently heavy to provide needed friction for the load it is going to carry it will only be necessary to make it heavy enough to provide the power, as the weight of the cars and their loads is depended upon to produce the desired friction.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Business and Personal Wants.

READ THIS COLUMN CAREFULLY.—You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. **In every case it is necessary to give the number of the inquiry.** MUNN & CO.

Marine Iron Works. Chicago. Catalogue free.

Inquiry No. 7551.—Wanted, address of parties selling "Telautograph."

For hoisting engines. J. S. Mundy, Newark, N. J.

Inquiry No. 7552.—Wanted, catalogue of cracker-making machinery.

"U. S." Metal Polish. Indianapolis. Samples free.

Inquiry No. 7553.—Wanted, address of parties making hard compressed paper, resembling hard rubber.

Drying Machinery and Presses. Biles, Louisville, Ky.

Inquiry No. 7554.—For manufacturers and dealers in brass tubing and other accessories for making brass and iron beds.

Sawmill machinery and outfits manufactured by the Lane Mfg. Co., Box 13, Montpelier, Vt.

Inquiry No. 7555.—For manufacturers of filtering apparatus or paper pulp mill machinery.

WANTED.—Purchaser for Monazite, Molybdenite and Wolfram. Apply Monazite, Box 773, New York.

Inquiry No. 7556.—For manufacturers of the new style cradles.

I sell patents. To buy, or having one to sell, write Chas. A. Scott, 719 Mutual Life Building, Buffalo, N. Y.

Inquiry No. 7557.—For makers of turned, polished machinery steel ¼ inch and ¾ inch diameter, any length.

The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Machine Company, Foot of East 138th Street, New York.

Inquiry No. 7558.—For manufacturers of machines for making brass lines for printing purposes.

A practical man wishes to invert $2,000 in a well-established machine shop. Must bear investigation. Investment, Box 773, New York.

Inquiry No. 7559.—For manufacturers of steel tubing 5-64 inch diameter on the inside and also steel wire that will fit the inside of the same.

WANTED.—Ideas regarding patentable device for water well paste or mucilage bottle. Address Adhesive, P. O. Box 773, New York.

Inquiry No. 7560.—For manufacturers of novelty calendars on labor-saving device.

I have for sale the U. S. and all foreign rights of new patent Improvements in Water Tube Types of Boilers. Great economizer. J. M. Colman, Everett, Wash.

Inquiry No. 7561.—For manufacturers of paper muslin.

LATEST ADVERTISING NOVELTIES.—High-grade Illustrating, Designing and Printing. Catalogues a Specialty. Smith & Berkley, Holland Bldg., St. Louis, Mo.

Inquiry No. 7562.—Wanted, a very small lamp, lantern or matter wet or dry that emits light, something similar to the lightning bug.

WANTED.—A Young Man familiar with drafting to assist superintendent in an iron casting plant. Good opportunity for advancement if capable. Draftsman, Box 773, New York.

Inquiry No. 7563.—For manufacturers of lawn figures, both human and animal.

Manufacturers of patent articles, dies, metal stamping, screw machine work, hardware specialties, machinery tools and wood fibre products. Quadriga Manufacturing Company, 18 South Canal St., Chicago.

Inquiry No. 7564.—For manufacturers of supplies for hop growers, especially hop poles.

Absolute privacy for inventors and experimenting. A well-equipped private laboratory can be rented on moderate terms from the Electrical Testing Laboratories, 548 East 80th St., New York. Write to-day.

Inquiry No. 7565.—For manufacturers of machinery for conveying sawmill waste into turpentine.

INVENTIONS WANTED.—Undersigned will consider one or two good patented or patentable inventions to manufacture on royalty. Something in popular demand preferred. Honest treatment guaranteed. F. Raniville Company, Grand Rapids, Mich.

Inquiry No. 7566.—For manufacturers of fancy brass goods for bedsteads.

FOR SALE.—A modern, up-to-date plant—established sixteen years. Suitable for woodworking of any kind. Direct freight tracks into factory. Wagon builders or automobile manufacturers would find a proposition worthy of most careful consideration in this offer. Address Sale, Box 773, New York.

Inquiry No. 7567.—For manufacturers of steam popcorn poppers.

FOR SALE.—Roller process flouring mill with 150 horse power, surplus water. Box 348, Petersburg, Mich.

Inquiry No. 7568.—For manufacturers of steel tubing, both light and heavy, suitable for shafting; also round tool steel suitable for making tools.

Inquiry No. 7569.—For manufacturers of smoke-saving device to eliminate smoke from bituminous coal.

Notes and Queries.

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(9846) T. H. P. asks: Is there any magnetic rod, or anything of the kind in use, for locating gold or silver? If so, where can I get one? A. There is no possible means of locating gold or silver ore by magnetism. Magnetism has no effect whatever on either of these metals, and any claim to locate deposits in the earth by a magnetic rod has no basis.

(9847) P. G. P. asks: Please tell me what is the nature of phosphorus? Can it be kept in a sealed bottle indefinitely? Will it retain its light-giving properties indefinitely? Will heat affect it? A. Phosphorus is one of the elementary substances, just as iron and lead are elements. It does not give light when it has been shut up in a bottle for some time. It can be kept under water anywhere. So long as it is kept away from oxygen it cannot give light or take fire. If the oxygen of the air has access to it, it grows hot and takes fire. Its light is due to the slow combustion of the phosphorus by oxygen, causing it to glow in the dark.

(9848) R. T. P. says: Will you please inform me how to polish aluminium? A. We would say that it is possible to get a beautiful finish on aluminium castings if the metal is cast under just the right conditions and in just the right kind of mold, but that it is very difficult indeed to polish aluminium which has been machined. The only suggestion we have to offer is to use a buffing wheel at high speed of cloth, felt, or leather, and to polish the aluminium in the same way you would silver, using fine emery, rotten stone, pumice stone, or whiting.

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Loom, C. Renger 805,751
Loom, filling replenishing, A. E. Stafford.... 805,497
Loom pattern mechanism, E. H. Ryon...... 805,756
Loom shuttle, self-threading, H. A. Kennedy 805,861
Mail box, Z. D. Tallman 805,759
Malt decoctions, producing tasteless roasted, M. Weyermann 806,007
Manure carrier, D. B. Cherry 805,842
Masonry, waterproofed, F. N. Pease........ 805,745
Matte, converting, Baggaley & Allen, 806,045, 806,046
Medicinal injector, N. J. Goldfarb 805,851
Metals, separation of, N. V. Hybinette.... 805,969
Metallic articles, covering, E. Kempshall.. 805,470
Metallic box, W. R. Dodd 805,454
Metallic mat, G. C. Sleeth 805,823
Metronome, L. Aurnhammer 805,436
Micrometer, F. G. Marbach 805,480
Mining machine, J. Swanson 805,685
Mining machine, W. H. Sexton 805,885
Moistener, finger, J. M. Keep........ 805,469
Mold, W. H. Lucas 805,655
Mold, Cimmery & Mottinger 806,066
Motor starting resistance, automatic, R. Scott 806,009
Mower, lawn, J. N. Bryant 805,900
Muffler, exhaust, F. S. Williams 805,613
Mushrooms, cultivation of, R. D. Kline.... 805,801
Music leaf turner, sheet, C. E. Shuler.... 805,822
Music rack, A. Krauth 805,734
Muzzle, F. M. Rowland 806,004
Nail clipper or wire cutter, H. Wilcox...... 806,037
Needle clamp, J. Grubb 805,721
Nut device, axle, L. J. Robichaux 805,755
Nut, lock, C. G. Wrisberg 805,829
Nut lock, H. L. Jinks 805,916
Oil burner, C. A. Peterson 805,747
Oil can, hand, G. H. Thomas 805,893
Oil to axle bearings, material for applying, W. E. Laycock 805,475
Ordnance, J. H. Brown 805,777
Ordnance, telescopic rammer for, A. A. Thresher 805,597
Ore separator, L. J. Vandervoort 805,599
Ore separator, magnetic, H. F. Campbell... 805,448
Ore separator, magnetic, E. Hedburg 805,854
Ores and the like, treatment of, J. Nicholas 805,577
Ores, etc., apparatus for dissolving and separating values contained in, C. H. Rider 805,880
Packing, E. H. Rice 805,609
Paint, treating, M. E. McMaster 805,984
Panel board, H. Krantz 805,650
Paper machine press rollers, polishing and grinding mechanism for, H. Schnitzer.. 805,585
Paper yarn, improving, M. Holken 805,553
Pen, fountain, J. Blair........ 805,624
Pencil box for slates, J. Koegel 805,472
Pencil sharpener, F. H. Smith........ 805,886
Phonograph attachment, Feist & Kretzer.... 805,787
Phonograph reproducing sound box or horn, R. Head 805,544
Piano action for pianos, E. Werner........ 805,602
Piano, automatic, F. Schaub 805,989
Piano pliers, C. H. Lang 805,651
Piling, metal sheet, W. G. Fargo 805,533
Pipe bender, Green & McFarland 806,065
Pipe cleaning device, J. E. Fliteroft 805,534
Pipe collar, M. C. Rosenfeld 805,487
Pipe tongs, H. R. Hill 805,913
Planer knife, F. L. Conforth 805,450
Planers, matcher head for wood, C. W. H. Blood 805,626

Planter, corn, E. H. Snyder ... 805,888
Planter, corn, Wertz & Warner ... 806,032
Planter, potato, Good & Gerling ... 806,081
Plaster, adhesive, H. G. Weber ... 806,061
Plastic material, machine for pressing, E. W. Rider ... 805,754
Plow attachment, I. Jefferson ... 805,800
Plow, wheeled, C. S. Ruef ... 805,488
Plug, ignition, C. F. Splitdorf ... 806,017
Poison distributer for plants, N. W. Ward, et al ... 805,689
Post. See Fence post.
Power appliance, W. E. Shaver ... 806,010
Power transmission, speed regulator for, C. Pfanschmidt ... 805,748
Power transmitting apparatus, C. R. Radcliffe ... 805,484
Printer's cabinet, H. Dorsey ... 806,071
Printing machine, stencil, D. Gestetner ... 805,536
Printing press web manipulating mechanism, H. F. Bechman ... 805,620
Processing or cooking or cooling machine, automatic, S. J. Dunkley ... 805,844
Projectile, E. M. Johnson ... 805,556
Projectiles, manufacture of caps for armor piercing, R. A. Hadfield ... 805,460
Propeller, F. W. McCain ... 805,871
Pulley, G. A. Gilbert ... 805,537
Pump, W. H. Shafer ... 805,586
Pump, air, T. N. Case ... 805,630
Pump, hydraulic air, G. J. Keenan ... 805,860
Pump, oil, J. B. Davis ... 805,580
Pump operating mechanism, A. E. Kepner ... 805,862
Pump, rotary, L. von Hofe ... 805,552
Punch, expanding, W. J. Marshall ... 805,868
Radiator, G. I. Rockwood ... 805,882
Rail, H. Herden, et al ... 805,954
Rail and rail joint connection, track, C. W. Clark ... 805,902
Rail brake, B. V. Gilmore ... 805,644
Rail clamp, guard, Butcher & Thomas ... 805,627
Rail, guard, W. H. Moore ... 805,928
Rail joint, H. Driehaus ... 805,638
Rail joint, J. E. Alexander ... 805,831
Rail joint, G. W. Thurman ... 806,023
Railway block system, Ireland & Reese ... 805,856
Railway rail joint, J. T. Evans ... 805,905
Railway signal, C. M. McGehee ... 805,872
Railway signal circuit, E. W. Vogel ... 805,827
Railway switch, L. L. Bigelow ... 805,773
Railways, apparatus for laying and taking up, G. I. Ritchie ... 805,881
Rammer motor, telescopic, A. A. Thresher ... 805,598
Range finder, F. Rump ... 805,584
Razor handle, G. W. Korn ... 805,561
Reaction engine, T. R. Almond ... 805,512 to 805,514
Reamer, A. J. Smart ... 806,011
Receptacle closure, J. H. Van Kleeck ... 806,028
Reclining chair, W. K. Rice ... 805,485
Recording or registering the maximum movement of any mechanism, mechanism for, L. B. Atkinson, reissue ... 12,413
Rein holder, E. G. Stevens ... 805,589
Rein holder, C. C. Shive ... 805,675
Rein support, Bethel & Peachey ... 805,772
Relay or sounder, electromagnetic, T. M. St. John ... 806,018
Rock drill, G. W. Smith ... 806,012
Rod. See Valve rod.
Roller attachment, H. F. Moser ... 805,807
Rolling chair, H. E. Weisgerber ... 805,605
Rotary engine, F. A. Headson ... 805,545
Rotary engine, C. O. Sylvester ... 805,886
Rotary engine, B. A. Carmody ... 805,840
Rotary engine, E. H. Holden ... 805,958
Rubber articles having interior cavities, vulcanizing hard, H. O. Traun ... 805,503
Rubber, dissolving and recovering, G. A. L. Cliff ... 805,903
Rug fastener, J. R. White, Jr. ... 805,611
Safety attaching device, H. C. Hense ... 805,548
Sash fastener, A. W. Dunn ... 805,639
Sash fastener, window, C. H. Williams ... 805,766
Sash holder and locking device combined, window, D. G. Freeman ... 805,907
Saw, butcher's, Wettich & Pitzer ... 806,033
Scale, grocer's computing, Silva & Vassallo ... 805,758
Scale indicator, weighing, Barry & Shaughnessy ... 805,518
Seal, E. J. Brooks ... 805,445
Self-closing seat and chair, T. S. James ... 805,799
Sewing machine thread controlling mechanism, D. Mills ... 805,870
Shade and curtain pole roller, window, F. Shoo ... 805,676
Shade bracket, H. Kirchhofer ... 805,973
Shaft casings, attachment for flexible, A. U. Patchen ... 805,579
Sheet metal, draw press for, J. L. Kelly ... 805,967
Ship loading and unloading apparatus, F. B. Clark ... 805,711
Ships' cabins, balanced floor for, R. P. Dewey ... 805,718
Shoe upper fastener, C. K. Sharood ... 805,757
Show case, knockdown, R. Mancha ... 805,479
Sickle holder, J. Walter ... 805,894
Sidewalk lights, tread piece for, E. R. Taylor ... 805,761
Sign, Crehen & Euwer ... 805,945
Sign support, E. L. Bell ... 805,622
Signal, P. A. Gordon ... 806,082
Signaling and electropneumatic train control system, electric, J. A. Whyte ... 806,035
Signaling mechanism, electrical, D. H. Coker ... 806,067
Signaling system, electric, W. S. & A. S. Aungst ... 805,619
Silk, bleaching artificial, C. A. Ernst ... 805,456
Skate brake, roller, G. M. Beals ... 805,942
Skates, ankle support for, R. N. Niblett ... 805,667
Skirt supporter and waist and belt retainer, D. Morrow ... 805,660
Sled, O. A. Essig ... 806,074
Smelting and converting ores, R. Baggaley ... 806,047
Snap hook, R. W. Hubbard ... 805,646
Snow moving machine, O. Sullivan ... 805,684
Sound producer, composite, E. Walker ... 805,600
Sound recording and reproducing machines, sound box for, J. Jetter ... 805,964
Sparking device, B. G. Gilbough ... 805,790
Sparring machine, J. Hayes ... 805,543
Speed indicator, H. Andrews ... 806,044
Spike lock, H. S. Waterman ... 805,690
Spindle driving mechanism, drill, Henry & Wright ... 805,546
Spinning frame, H. Spence ... 806,016
Spinning frame thread guide, Tytler & Bowker ... 806,024
Spinning machine, G. J. Cuzner ... 806,068
Spinning machine, D. O. Pease ... 805,998
Spring bottom, G. C. Locklin ... 805,569
Spring wheel, W. H. Jackson ... 805,647
Square, folding, T. Jarvis ... 805,467
Stacker, pneumatic, O. Puterbaugh ... 805,997
Staging clamp, U. Facette ... 805,949
Stalk cutter, J. J. Dorman ... 805,455
Stamp affixer, L. B. Hampton ... 805,723
Stamp affixing device, L. E. Smith ... 805,887
Standard, adjustable, E. S. Bryant ... 805,524
Steam generator, instantaneous, F. P. Hummel ... 805,961
Steel, manufacture of, H. W. Lash ... 805,563, 805,564
Stenciling device, A. E. Williams ... 805,765
Stock drying apparatus, C. W. Schwartz, Jr. ... 805,985
Stone mold, artificial, J. M. Hutchinson ... 805,962
Stool back, adjustable, C. C. Augustine ... 805,516
Stores, package delivering apparatus for, E. Roberts ... 806,001
Stove, gas, H. J Bresson ... 805,706
Stovepipe elbows, making corrugated, A. G. Scherer ... 805,490
Stovepipe fastener, F. P. Richards ... 805,753
Stovepipe thimble connection, J. W. Mahaffy ... 805,656
Sulfur, recovering, R. Baggaley ... 805,701
Supporter loop, I. B. Kleinert ... 805,559
Swimming appliance, A. M. Bullock ... 805,526
Swimming appliance, W. P. Samms ... 805,672
Swimming device, A. M. Bullock ... 805,525
Switch. See Railway switch.
Swivel, ring, and lap ring, combined, J. C. Hackett ... 805,909
Table lock, extension, J. L. Arnold ... 805,696
Tablet, continuous writing, P. M. Wise ... 806,041
Talking machine attachment, J. H. Lutz ... 805,923
Telegraph key, rear end contact, S. B. Leeley ... 805,735
Telegraphy, receiver for wireless, H. S. Blackmore ... 806,062
Telephone exchange system, H. T. Cedergren ... 805,901
Telltale, R. H. Cobb ... 805,713
Tile, roofing, L. G. Satterlee ... 805,884

Tire, non-puncturable, Davison & Logan... 805,591
Tire shrinking machine, cold, S. N. House 805,796
Tire, vehicle, Allen & Pogue... 805,434
Tires, device for relieving pressure on motor vehicle, J. C. Wands ... 806,089
Tires, means for inflating rubber, Lavertine & McNellan ... 805,474
Tires of motor vehicles, jack for relieving pressure on pneumatic, J. C. Wands... 806,088
Tires to rims of wheels, means for securing pneumatic, S. Smith ... 806,013
Tobacco bag nozzle, M. Granat ... 806,084
Tobacco package, chewing, A. Marschner.. 805,806
Tomato scalder, Clark & Terry ... 805,632
Tool, pneumatic, J. F. Clement ... 805,633
Tool, pocket, J. T. Rosenheimer ... 805,486
Tooth fastening for bridgework, artificial, T. H. Whiteside ... 806,034
Torpedoes, etc., igniting mechanism for air, W. T. Unge ... 806,026
Toy, musical, D. Howe ... 805,727
Toy pistol, F. Campbell ... 806,063
Trace attaching member, A. K. Baltezor .. 805,704
Track bracket, G. A. Swineford ... 806,020
Track laying machine, N. Bennett ... 805,623
Track laying machine, McCabe & Steen.... 805,808
Traveling bag, telescope, A. B. Sprague.... 805,680
Trolley base, H. E. Lockhart ... 805,568
Trolley wheel, A. H. Mathesius ... 805,572
Truck, car, J. Taylor ... 806,022
Truck frame and pedestal, car, Wright & Stebbins ... 805,940
Tubing, flexible, Sussman & Wilner ... 805,825
Turbine, elastic fluid, W. S. Elliott, 806,072, 806,073
Turbine, steam, Bryant & Bery ... 805,523
Twisting apparatus, yarn, A. E. Rhoades.. 805,752
Twyer plate for Bessemer converters, McDonald & Morgan ... 805,931
Type casting and setting machine, J. R. & G. A. Pearson ... 805,580
Typewriter ribbon spool, H. M. Colvin.... 805,634
Typewriter type cleaner, S. C. Callaway... 806,062
Type writing machine, F. W. Hillard ... 805,956
Umbrella, W. H. Hoffman ... 805,957
Umbrella handle, M. J. Ades ... 805,615
Umbrella lock, F. A. Wilson ... 806,040
Vaginal irrigator, M. Vidaver ... 805,826
Valve, F. L. Smith ... 805,677
Valve, H. G. Ginaca ... 805,850
Valve, automatic safety check, T. L. Stewart ... 805,498
Valve gear mechanism, F. Lamplough.... 805,562
Valve, reversing, O. Hove ... 805,726
Valve rod and wrist pin connection, A. Skofsrud ... 805,587
Valve, rotary, R. L. Donaldson ... 805,531
Vaseline, preparation of water soluble, F. Boleg ... 805,443
Vehicle body, H. H. Rice ... 805,668
Vehicle, motor, W. D. Lowe ... 805,740
Vehicle wheel, E. Cantono ... 805,528
Vehicle wheel, G. Schram ... 805,673
Vehicle wheel, Glaser & Olsen ... 806,080
Vehicles, apparatus for settling dust raised by motor, S. S. Stitt ... 805,824
Vessel, collapsible, W. M. Fulton ... 805,720
Vessels, means for stopping the motion of, E. F. A. Villette ... 805,688
Vise, T. Hadden ... 805,792
Visible and audible signal, J. L. Creveling. 805,714
Washer. See Gas washer.
Washing machine, L. D. Thornburgh ... 805,596
Watering apparatus, stock, W. M. Anderson 805,617
Well plunger, tubular, E. R. Lockwood.... 805,922
Wells, electric heater for oil, Williamson & Collins ... 806,039
Wheel, R. A. Boyer ... 805,837
Wheel rim, vehicle, E. Weller ... 805,828
Whiffletree coupling, A. J. Burger ... 805,527
Whip attachment for horse powers, T. J. Leigh ... 805,476
Whistle, W. A. Pardoe ... 805,817
Winder, C. N. Childs ... 806,065
Windlass, tree felling, H. Buttner ... 805,628
Window, C. A. Bingham ... 805,440
Window, B. J. Leslie ... 805,565
Window frame and sash, metallic, S. F. Hicks ... 805,549
Window frames, doorways, etc., fixture for, A. H. Hauk ... 805,853
Window screen, M. Solmson ... 805,495
Window screen, C. W. Mattern ... 805,977
Wire, barbed, C. O. Neubauer ... 805,932
Wire cutting mechanism, N. S. Harter.... 805,724
Wire rope clamp, C. H. Billman ... 805,705
Wire splicer and tightener, Regenier & Hamby ... 805,666
Wire stretcher, J. Lambert ... 805,473
Wire stretcher, splicer, and tightener, combined, W. D. Miller ... 805,926
Wood, machine for graining and otherwise ornamenting, H. C. Johnson ... 805,858
Wooden and other surfaces, compound for finishing, F. Hunerbein ... 805,466
Wrench, Warren & Preston ... 805,506
Wrench, J. P. A. Hanlon ... 805,793
Wrench, A. L. Crittenden ... 805,946
Wrench, J. W. Butler ... 806,061
Wrench and pipe cutter, F. Minck ... 805,927
X-ray tube, J. O. Heinze, Jr. ... 805,795
Yarn, etc., apparatus for testing and registering the degree of inequality of, E. Hersog ... 805,912

DESIGNS.

Can top, sheet metal, H. O. Hyatt ... 37,700
Fabric, textile, A. Guelle ... 37,701, 37,702
Fabric, textile, P. Mouton ... 37,703
Fabric, textile, J. F. C. Deble ... 37,704
Spoons, forks, or similar articles, handle for, G. C. Lunt ... 37,699
Type, font of, C. Schraubstadter... 37,705, 37,706

TRADE MARKS.

Ale, C. H. Evans & Sons ... 47,951
Bay rum tablets, C. S. Marshal ... 47,924
Beer, Indianapolis Brewing Co. ... 47,960
Belt dressing, bar, New York Leather Belting Co. ... 47,886
Binders, loose leaf, Sieber & Trussell Mfg. Co. ... 47,908 to 47,911
Bleaching and washing linens, compounds for, Roessler & Hasslacher Co. ... 47,940
Bone black, Michigan Carbon Works ... 47,905
Bonnets and hat frame, materials used for, Stadecker & Emsheimer ... 47,889
Boots and shoes, leather, Geo. D. Witt Shoe Co. ... 47,896
Boots and shoes, leather, M. Hessberg, 47,897, 47,898
Bracelets, lockets, and brooches, miniature, Wightman & Hough Co. ... 47,890
Cabinets for manifolding account books, National Cash Register Co. ... 47,850
Candy, E. T. Hopkins ... 47,881
Cards, playing, New York Consolidated Card Co. ... 47,853
Chain blocks for hoisting machinery, J. G. Speidel ... 47,912
Cigarette paper, A. A. Kohary ... 47,900
Cleaning, scouring, and polishing compounds, Sel-on-Site Manufacturing Co. ... 47,917
Coats, pants, overalls, and blouses, Larned, Carter and Co. ... 47,849
Corsets, Bay State Corset Co. ... 47,876
Corsets, Kops Bros. ... 47,883
Cotton piece goods, Massachusetts Cotton Mills ... 47,884
Crackers and cakes, Independent Baking Co. 47,922
Dentifrices, L. W. Dutro ... 47,950
Electric conductors, flexible conduit for, Alphaduct Manufacturing Co. ... 47,973
Electric motors and generators, dynamo, Sprague Electric Co. ... 47,913
Envelops, A. Plant ... 47,907
Fabrics for suitings for men and boys, cloth, T. Oakes & Co. ... 47,974
Fabrics for walls and ceilings, decorative, Fr. Beck & Co. ... 47,975
Fabrics, woolen and worsted, R. F. Shaen.. 47,887
Fish, salt, W. H. Lord ... 47,954
Foods, bird, Brookman Manufacturing Co... 47,945
Gage glasses, Schaeffer and Budenberg Mfg. Co. ... 47,916
Games, card, United States Playing Card Co. ... 47,854 to 47,860, 47,862 to 47,875
Gin, G. W. Meredith ... 47,936

Gin, Albert M. Gugenheim Co.	47,969
Glass chimneys, lantern globes, and reflectors, Gill Brothers Co.	47,934
Glass vessels for table use, Cambridge Glass Co.	47,970
Grain drills and seeders, Van Brunt Mfg. Co.	47,918
Hats, Boogher, Force & Goodbar Hat Co.	47,891
Hooks and eyes, Peet Bros.	47,906
Knitted hosiery, underwear, and sweaters, Knoxville Knitting Mills Co.	47,882
Lozenges, New England Confectionery Co.	47,885
Malt extract for brewers' use, Indianapolis Brewing Co.	47,959
Malt extracts and peptonized malt foods, A. Lieber	47,953
Medicinal preparation for catarrh, asthma, hay fever, and lung troubles, Doctor Blosser Co.	47,920
Medicines, blood and nerve, L. C. Geiser Medical Co.	47,923
Medicines for stomach and bowel troubles and rheumatic pains, G. G. Norris' Sons.	47,921
Mineral waters, French Lick Springs Hotel Co.	47,879
Molasses, P. Duff & Sons	47,949
Moth bags, T. Manahan	47,904
Moth paper and moth bags, T. Manahan	47,903
Moth sheets and bags, M. E. Manahan	47,902
Olives, C. Gulden	47,952
Overalls, coats, jumpers, and trousers, Brattleboro Overall Co.	47,892
Paints and supplies, certain named, Standard Varnish Works	47,851
Paints, ready mixed, Geo. D. Wetherill & Co.	47,895
Peanuts, Garcia & Maggini	47,976
Pellets, worm, W. H. Comstock Company	47,963
Pepper sauce, D. C. Danove	47,948
Pins, safety, Consolidated Safety Pin Co.	47,893
Pipe cutters, metal, Barnes Tool Co.	47,914
Plasters, C. A. Staab	47,957
Popcorn and candied popcorn, C. M. Waite	47,964
Preparation for diseases of the mucous membrane and skin, Marveline Company	47,955
Quinin, Roessler & Hasslacher Chemical Co.	47,962
Remedy for asthma and similar diseases, W. R. Warner & Co.	47,965
Remedy for certain named diseases, Antikamnia Chemical Co.	47,939
Rope, cord, and twine, C. Bailey & Son	47,931
Saleratus, bicarbonate of soda, and salsoda, Church & Dwight Co.	47,947
Soap, toilet, F. G. Burke	47,877
Soaps, laundry, toilet, and shaving, F. L. Falck & Co.	47,878
Soda, Holman & Co.	47,968
Soda, saleratus, and baking powder, bicarbonate of, Church & Dwight Co.	47,946
Sugar, syrup, molasses, and glucose, Goyer Alliance Refining Co.	47,966
Suspenders and braces, Harris Suspender Co.	47,880
Tin, oxid of, Roessler & Hasslacher Chemical Co.	47,925
Tobacco extracts for insecticides, Kentucky Tobacco Product Co.	47,961
Tobacco, plug cut, plug, and smoking, J. G. Dill	47,848
Tonic, Valley Chemical Co.	47,930
Trees, nursery grown plum, Albaugh Nursery and Orchard Co.	47,852
Underwaists and underwear, Ferris Bros. Co.	47,889
Underwear and hose, Lawrence Manufacturing Co.	47,901
Varnishes, David B. Crockett Co.	47,915
Vehicles, children's hand and foot propelled, Gendron Wheel Co.	47,894
Whiskies, Edgewood Dist'g Co.	47,971
Whisky, Cavanagh & Co.	47,919
Whisky, Star Distillery Co.	47,926, 47,927, 47,929
Whisky, Calhoun Distilling Co.	47,932
Whisky, Charles Dennehy & Co.	47,933
Whisky, M. Kirschbaum	47,935
Whisky, Mueller, Wathen & Kobert	47,937
Whisky, L. Nelson	47,938
Whisky, H. Varwig & Son	47,941
Whisky, Wm. Hoelscher & Co.	47,942
Whisky, D. Wolff & Sons	47,943, 47,944
Whisky, Monheimer & Co.	47,956
Whisky, Roxbury Distilling Co.	47,972
Whisky, rye and bourbon and all kinds of, S. C. Herbst	47,967
Yeast, Snyder Yeast Co.	47,958

LABELS

"Borala Powder," for a medicine, J. A. Begy	12,501
"Columbia Malt Whisky," for malt whisky, Flegenheimer Bros.	12,514
"Cresto Rye," for rye whisky, Flegenheimer Bros.	12,515
"Eden Garden Remedy," for medicine, A. E. Nelson	12,500
"Esselmann Frame for Quality," for frames, Geo. Esselmann Co.	12,519
"Excelsior Surfacing Solution for Draftsmen and Bookkeepers for Use After Making Erasures," for a surfacing solution, A. H. Stow	12,517
"Gingo-Blackberry," for blackberry brandy, Flegenheimer Bros.	12,512
"La Pampas," for cigars, J. Knecht	12,503
"Magneto Cocktails," for cocktails, Flegenheimer Bros.	12,510
"Medico Gin," for Holland gin, Flegenheimer Bros.	12,511
"Moravian Rugs," for rugs, R. Deutsch	12,521
"Mother's Kisses," for candy, Saginaw Kiss Co.	12,499
"Owatonna Vichy," for mineral water, Minnero Chemical Co.	12,508
"Peacock Brand," for syrup, Southern Syrup Co.	12,498
"Perfection, Guaranteed Nine Months Old," for beer, F. H. Horlacher	12,509
"Pulmo Rock and Rye," for rye whisky, Flegenheimer Bros.	12,513
"Ruberoid Roofing," for roofing, Standard Paint Co.	12,518
"Salada, 15 cents, Black," for tea, P. C. Larkin	12,506
"Salada, 15 cents, Ceylon and India Green Tea," for tea, P. C. Larkin	12,504
"Salada, 20 cents, Black," for tea, P. C. Larkin	12,505
"Salada, 20 cents, Ceylon and India Green," for tea, P. C. Larkin	12,507
"Shoffners Sure Cure," for medicine, Shoffner-Hayes Medicine Co.	12,502
"The Ideal Chamber Organ Orgue de Salon," for organs, Art Organ Company	12,520
"Togo," for a cleaning fluid, O. B. Smith	12,516

PRINTS

"Buob & Scheu's Order Chart for Propeller Tops," for propeller tops, Buob & Scheu	1,502
"Clothes of Quality," for clothing, M. Wile & Co.	1,495
"Dr. Cole's Yellow Dragon Vitalizer," for medicine, A. L. Cole	1,497
"Dr. Williams' Fly & Insect Destroyer," for insecticide, F. Williams Co.	1,498
"Front View of the Ideal Seed Cabinet," for seed cabinets, Planters Seed Co.	1,499
"Neurilla," for medicine, Dad Chemical Co.	1,496
"Rear View of the Ideal Seed Cabinet," for seed cabinets, Planters Seed Co.	1,500
"The Federal Lithograph Co., Furniture Poster," for furniture, Federal Lithograph Co.	1,501
"The Federal Lithograph Co., Shoe Poster," for shoes, Federal Lithograph Co.	1,494

A printed copy of the specification and drawing of any patent in the foregoing list, or any patent in print issued since 1863, will be furnished from this office for 10 cents, provided the name and number of the patent desired and the date be given. Address Munn & Co., 361 Broadway, New York.

Canadian patents may now be obtained by the inventors for any of the inventions named in the foregoing list. For terms and further particulars address Munn & Co., 361 Broadway, New York.

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